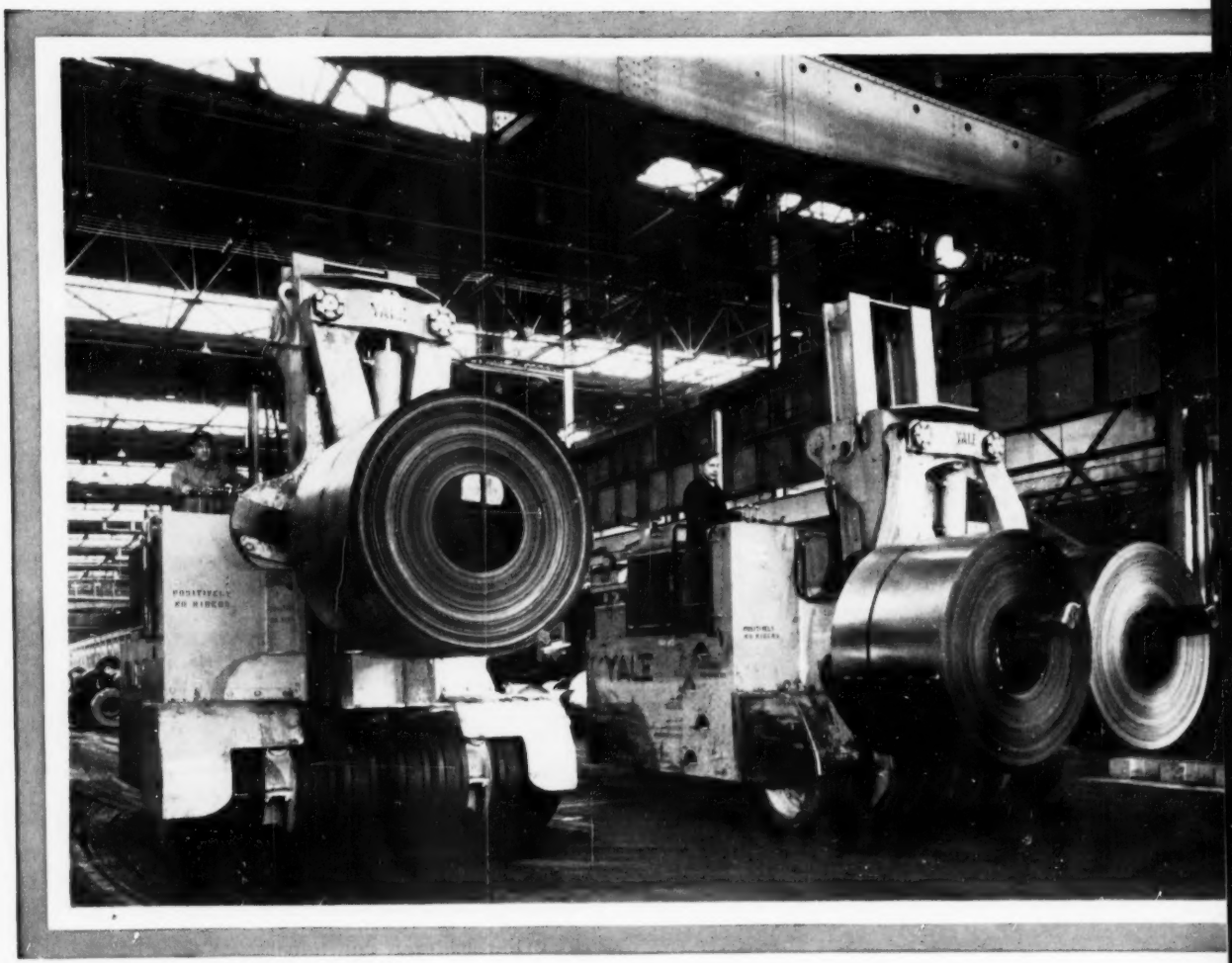
DIESEL POWER

AND DIESEL TRANSPORTATION

NOVEMBER, 1953



- ***Which Fuel for City-Bus Operation***
- ***Diesels Supplement Hydro Power***

SAVE FUEL

YOU CAN cut fuel consumption by effective lubrication — that is, using the oil that is exactly suited to your engines and operating conditions. This would be one of the famous *Texaco Ursa Oil* series — *a complete line* of lubricating oils for Diesel, gas and dual-fuel engines.

The *Texaco Ursa Oil* recommended as right for your engines will assure clean operation . . . freedom from harmful, power-stealing deposits . . . free rings for proper compression and combustion. Thus you'll save fuel, reduce your maintenance costs.

Texaco Ursa Oils are approved by leading engine builders and preferred by operators everywhere. A Texaco Lubrication Engineer will gladly help you select the proper one for your engines. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

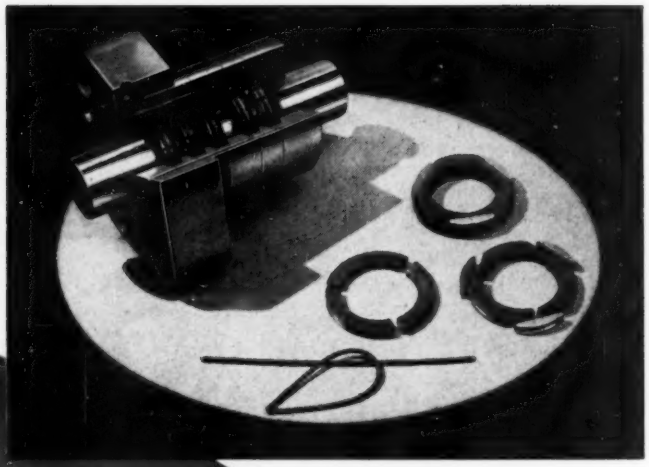
TEXACO

TEXACO

URSA OILS

FOR ALL DIESEL, GAS AND DUAL-FUEL ENGINES

EXTRA years of service are built into COOK piston and packing rings!



HERE ARE THE THREE BIG REASONS WHY–

ADVANCED METALLURGICAL TECHNIQUES

Quality control of Cook rings starts with the basic materials and follows through to the time the rings are delivered to you. Our own foundry makes pot type castings from special mixes to obtain Cook Graphitic Iron and Cookmet Bronze castings. These pot castings assure balanced distribution of the metal and eliminate undue stresses in the finished ring. Constant analysis of the metal guarantees top quality material.

PRECISION MANUFACTURING

Cook piston and packing ring blanks are turned from the normalized pot castings on specially designed machines. They are precision ground and mechanically tensioned by an exclusive process to provide correct unit pressure for the application. Precision workmanship prevails throughout. The completed rings conform to the most rigid inspection requirements.

FIELD RESEARCH and JOB ENGINEERING

Our engineers are constantly testing and experimenting to obtain the right ring combination for your specific engine or compressor. The ring recommendations based on this data are "job-engineered" to your requirements.

This combination of quality control, precision workmanship, rigid inspection, and "job-engineered" recommendations, is why you can count on years of efficient, trouble-free service when you use Cook piston rings and packings.

COOK

PISTON RINGS and PACKINGS

SEALING PRESSURES SINCE 1888

GET THIS VALUABLE PISTON AND PACKING RING INFORMATION TODAY—

BULLETIN NO. GI-1—contains numerous facts and data on installation and maintenance of Cook's metallic packing for all types of compressors.

BULLETIN NO. GI-2—condensed information on the application of Cook's graphitic iron piston rings for all diesel engines and compressors.

C. LEE COOK MFG. CO., INCORPORATED
DEPT. 2, LOUISVILLE 3, KENTUCKY

Representatives in principal industrial cities.

DIESEL POWER
AND DIESEL TRANSPORTATION

Brian P. Emerson, *Editor*
C. W. Kinnear, *Special Railroad Representative*
John H. Wetherell Jr., *Associate Editor*
Sylvia Zegar, *Editorial Assistant*

Established In 1923

GEORGE R. BRIGHTON
President

JAMES E. JONES
Vice President & Treas.

G. RENFREW BRIGHTON
Vice President & Sec'y.

ARNOLD B. NEWELL
Vice President

WILBUR W. YOUNG
Assistant Publisher

ARTHUR N. GODING
Business Manager

HERBERT C. SPENCER
Circulation Mgr.

M. D. PUGH, Pacific Coast Manager
2721 North Marengo Avenue
Altadena, California

FRED WRIGHT COMPANY
Southwestern Representative
411 No. 10th, St. Louis, Mo.
505 North Erway, Dallas, Tex.

NEWSPAPER REPRESENTATIONS, Ltd.
British Representative
231 Strand, London, WC 2, England

Subscription Rates

	Single Copies	1 year	2 years	3 years
U. S.	35¢	$3.00	$5.00	$ 6.00
Canada	40¢	4.00	7.00	9.00
Foreign	40¢	5.00	8.00	11.00

Diesel Power & Diesel Transportation is indexed regularly by Engineering Index, Inc. and is available in microfilm editions from University Microfilms, Inc., Ann Arbor, Michigan.

November, 1953

Vol. 31, No. 11

Cover Photo: High-speed production methods demand greater capacity in materials handling equipment. Pictured are two diesel-electric giants in Yale's family of lift trucks. Called ram trucks, they are shown transporting heavy rolls of sheet steel.

EDITORIAL

What About Tariffs? 29

ARTICLES

Diesels Supplement Hydro Power 32
The Lakehead Pipeline Goes Through 36
Williamsport Technical Institute 39
Teague, Texas Adds an Engine 40
Small Diesels At Work 44
Which Fuel For City Bus Operation? 50
Containing Crankcase Explosions 54
Annual LMOA Convention Proceedings 57
Metered Maintenance At Broken Bow, Nebraska 58
Caterpillar's Oil-Type Clutch 61

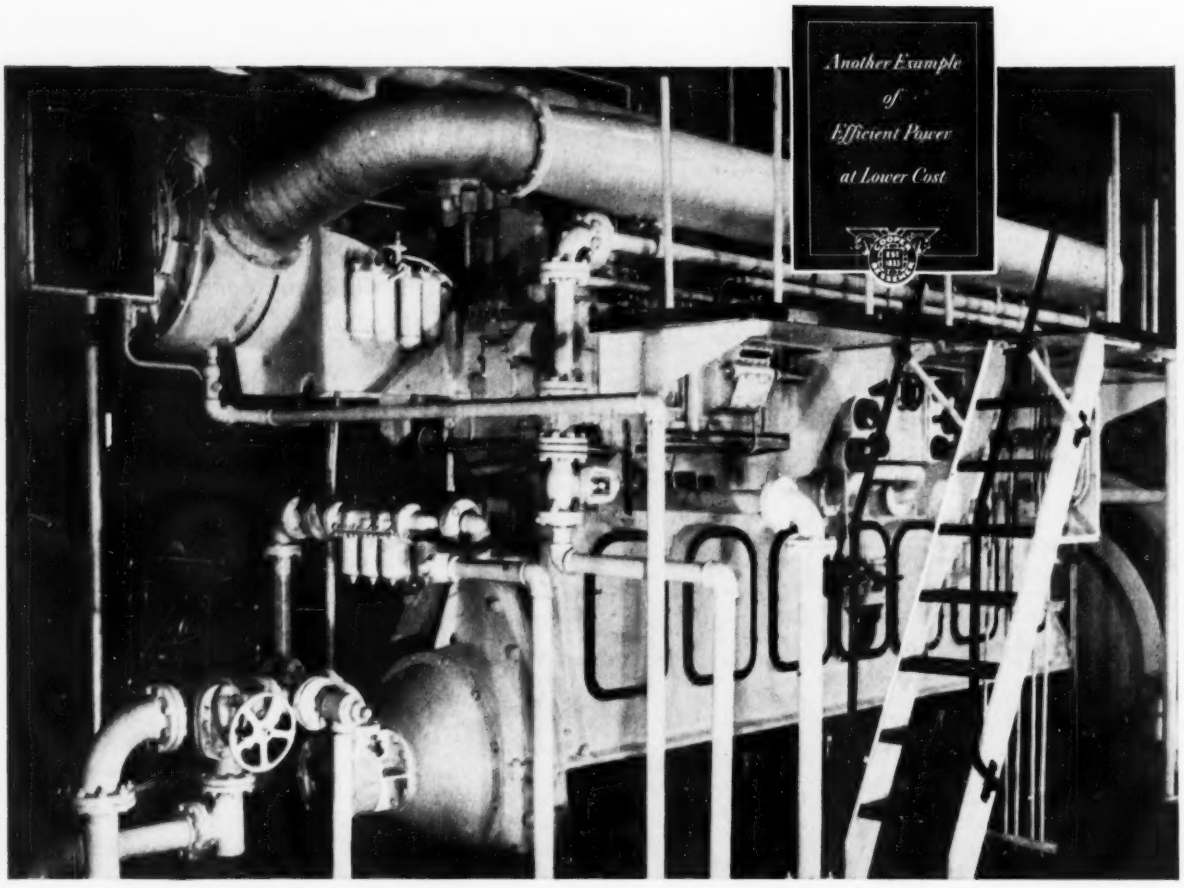
DEPARTMENTS

Highlights 31
What Do You Know! 38
Diesel Briefs 48
Straight from the Tool Box 62
Product Previews 64
Field Notes 76
Ad Index 88

Diesel Publications, Inc., 192 Lexington Avenue, New York 16, N. Y.

DIESEL POWER and DIESEL TRANSPORTATION for November, 1953 Vol. XXXI, No. 11. It is published monthly by Diesel Publications, Inc., Kutztown, Pa. Executive and Editorial Offices at 192 Lexington Ave., New York 16, N. Y. Tel. MUrray Hill 3-9874. Entered as second class matter at the Post Office, Kutztown, Pa., under Act of March 3, 1879.

Copyright 1953, Diesel Publications, Inc.



FOR SEWARD, ALASKA...
a 15% cut in generating cost!

THE modern, turbocharged 1,150 hp Cooper-Bessemer diesel shown above represents Seward's latest step in better serving expanding industry and population growth.

Not only does this new diesel provide the city-owned Seward Electric System with an additional 800 KW, but it does it with the exceptional efficiency and economy customary with Cooper-Bessemers wherever they serve. Compared with previously installed equipment, Seward's new unit produces power at 15% less cost!

If your plans call for new or expanded power facilities, better find out what you can save with modern Cooper-Bessemer diesel, gas or gas-diesel engines. Check with the nearest office.

The Cooper-Bessemer Corporation

MOUNT VERNON, OHIO — GROVE CITY, PENNA.

New York Washington, D. C. Bradford, Pa. San Francisco Houston, Dallas, Greggton, Pampa and Odessa, Texas Seattle Tulsa Shreveport St. Louis Los Angeles Chicago Caracas, Venezuela Cooper-Bessemer of Canada, Ltd., Halifax, Nova Scotia Gloucester, Mass. New Orleans, La.

Exide

XF HEAVY-DUTY BATTERIES

Way out in front for dependable performance and year-round economy. That's because the Exide XF is "Custom-engineered" for diesel starting. It's a product of years of progressive research-engineering . . . of intensive testing under severe operating conditions. The Exide XF battery offers

OUTSTANDING FEATURES:

New grid alloy • New active material—G.O.X.
Lower gravity electrolyte • New dual insulation

WITH EXIDE XF BATTERIES YOU GET:

EXTRA LONG LIFE—longer than you ever thought possible.
QUICK BREAKAWAY and fast acceleration of engine to firing speed.
RUGGED CONSTRUCTION for rough usage in hard service.
LOW COSTS of operation and maintenance.

Now, more than ever before . . .
EXIDE IS YOUR BEST BATTERY BUY... *AT ANY PRICE!*

1888 . . . DEPENDABLE BATTERIES FOR 65 YEARS . . . 1953

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 2 • *Exide Batteries of Canada, Limited, Toronto*
"EXIDE", *Reg. T.M. U.S. Pat. Off.*

...with TYCOL lubricants on hand!

It pays to buy a "Diesel-Designed" Lubricant! ... It takes "something more than a motor oil" to counteract excessive wear in Diesel engines – and we proved it with Tycol Adeltran 40! In this instance, a Diesel engine was operated for one year with a competitive oil. An overhaul by the manufacturer turned up these conditions: all liners had to be replaced as well as piston rings ... 2 top compression rings were stuck and all rings were gummed up. After the switch to Adeltran (for the same operating period) liner wear was negligible ... filter life was considerably extended ... all rings were free and in excellent condition ... and owner reported an exceptionally clean engine base. For full details on Adeltran, contact your local Tide Water Associated office!

TYCOL
INDUSTRIAL LUBRICANTS

Boston • Charlotte, N. C. • Pittsburgh
Philadelphia • Chicago • Detroit
Tulsa • Cleveland • San Francisco
Toronto, Canada

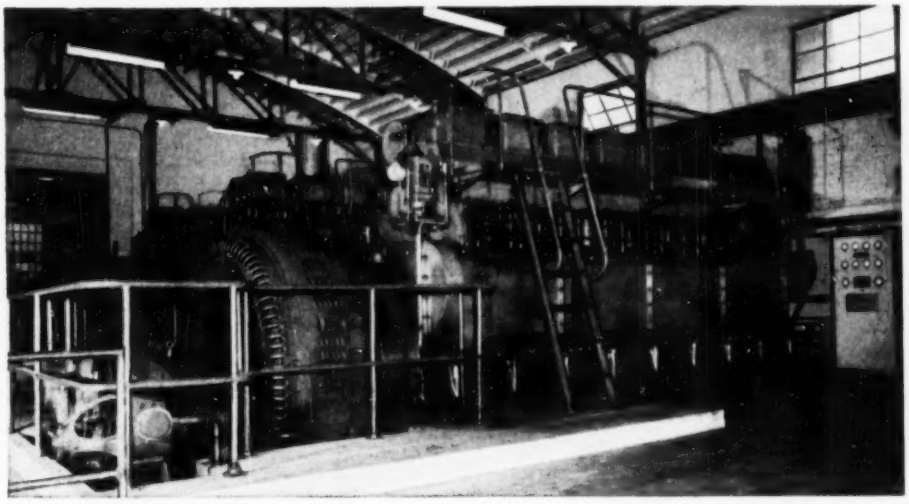
Over 300 Tycol industrial lubricants are at your disposal ... engineered to fit the job!

TIDE WATER ASSOCIATED OIL COMPANY
17 BATTERY PLACE · NEW YORK 4, N.Y.

REFINERS AND MARKETERS OF VEEDOL ... THE WORLD'S MOST FAMOUS MOTOR OIL

50% longer service
over 200% better efficiency
and going strong

. . . Koppers Piston Rings, Municipal Power Plant, Tarboro, N.C.



Koppers Porous Chrome* Rings. Porous chrome surface holds and distributes oil during break-in. Seats quickly. This chrome prevents grit from embedding in ring surface. Prevents cylinder wall scratching. Reduces wear 50%. Last 4 times longer than other rings.

If you want proof *that the installation of Koppers Piston Rings saves on lubricating oil, cuts down labor costs, makes for fuel oil savings . . . all at the same time . . .*

then, read this!

In 1949, to increase the capacity of the Municipal Power Plant in Tarboro, North Carolina, three additional diesels were installed. The Operations report, previous to installing Koppers Piston Rings, showed that average lube oil consumption over a ten month period (the approximate life of the rings) was less than 700 HP hours per gallon.

After installing a complete set of Koppers Rings, the Operations report showed over 2500 HP hours per gallon. And after running under emergency conditions for *15 months*, these rings are *still going strong.*

Here's just one more case where the installation of Koppers Piston Rings has improved engine performance. We can show you many more.

Tarboro not only saves in lubricating oil, but through the use of chrome rings is operating on #5 Diesel fuel oil without excessive wear. With original ring set, cylinder wear during an 8 month period totaled .035". With the Koppers ring set, cylinder wear during a *15 month* period totaled only .010". . . 1/7 *as much wear.*

Does this suggest savings in operating and replacement costs to you? Then remember Koppers Piston Rings next time you have a diesel overhaul. First thing, investigate Koppers Conformable and Porous Chrome* Rings. And for special assistance with your specific piston ring problems, consult our technical staff.

Koppers Conformable Ring maintains constant unit pressure for positive oil control. Conforms readily to meet cylinder distortion because flexible cast iron member is pressed outward by abutment type spring which exerts uniform radial pressure around entire circumference.

*Van der Horst Process

KOPPERS®

AMERICAN HAMMERED
Industrial Piston Rings

METAL PRODUCTS DIVISION • KOPPERS COMPANY, INC. • Baltimore, Maryland

This Koppers Division also supplies industry with Fast's Couplings, Aeromaster Fans, Koppers Electrostatic Precipitators and Gas Apparatus.

Engineered Products Sold with Service

KOPPERS COMPANY, INC., *Piston Ring Dept.*, 1641 Hamburg Street, Baltimore 3, Md.

Gentlemen: Please send me full information on your Conformable Oil Ring.

Name .....

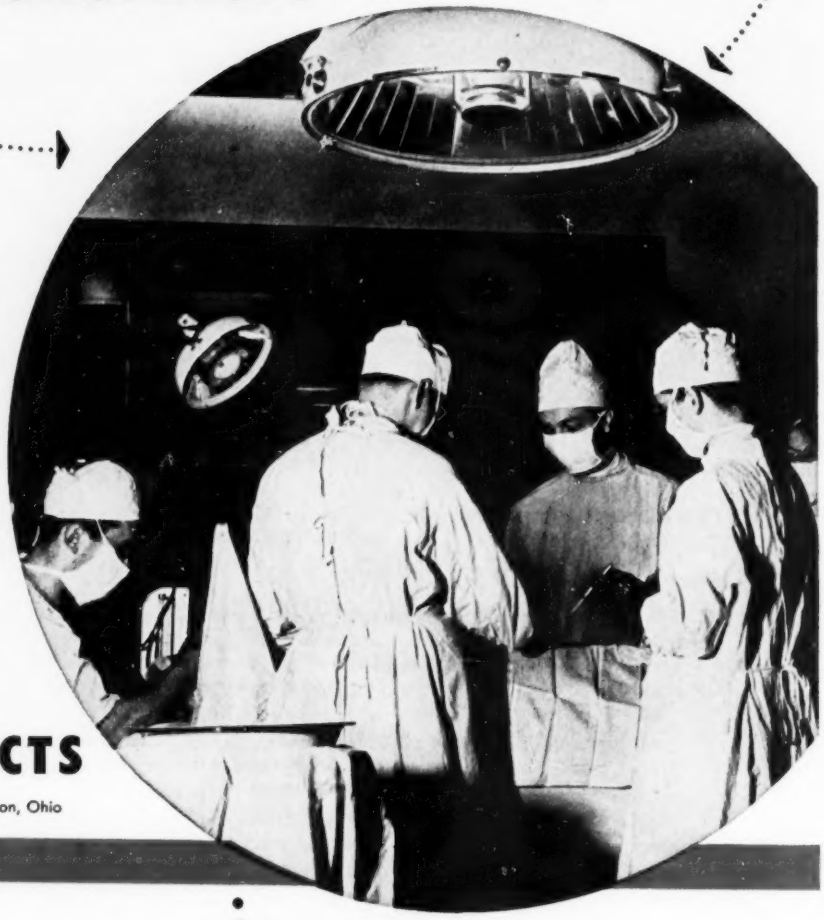
Company .....

Address .....

City ..... Zone ..... State .....

For stand-by power

Delco Generators



Delco generators are designed to serve Diesel power plants effectively . . . and without fail. With a power range of 20 kw through 200 kw, AC and DC, 1200, 1500, and 1800 rpm. Delco generators have kept pace with Diesel engineering.

Hospitals, schools, public buildings, carnivals, circuses and outside construction jobs frequently call for power from an independent source. At such times Delco generators, time and again, prove their dependability for stand-by or portable service. Any of the sales offices listed below will be glad to supply detailed information.

DELCO DAYTON OHIO

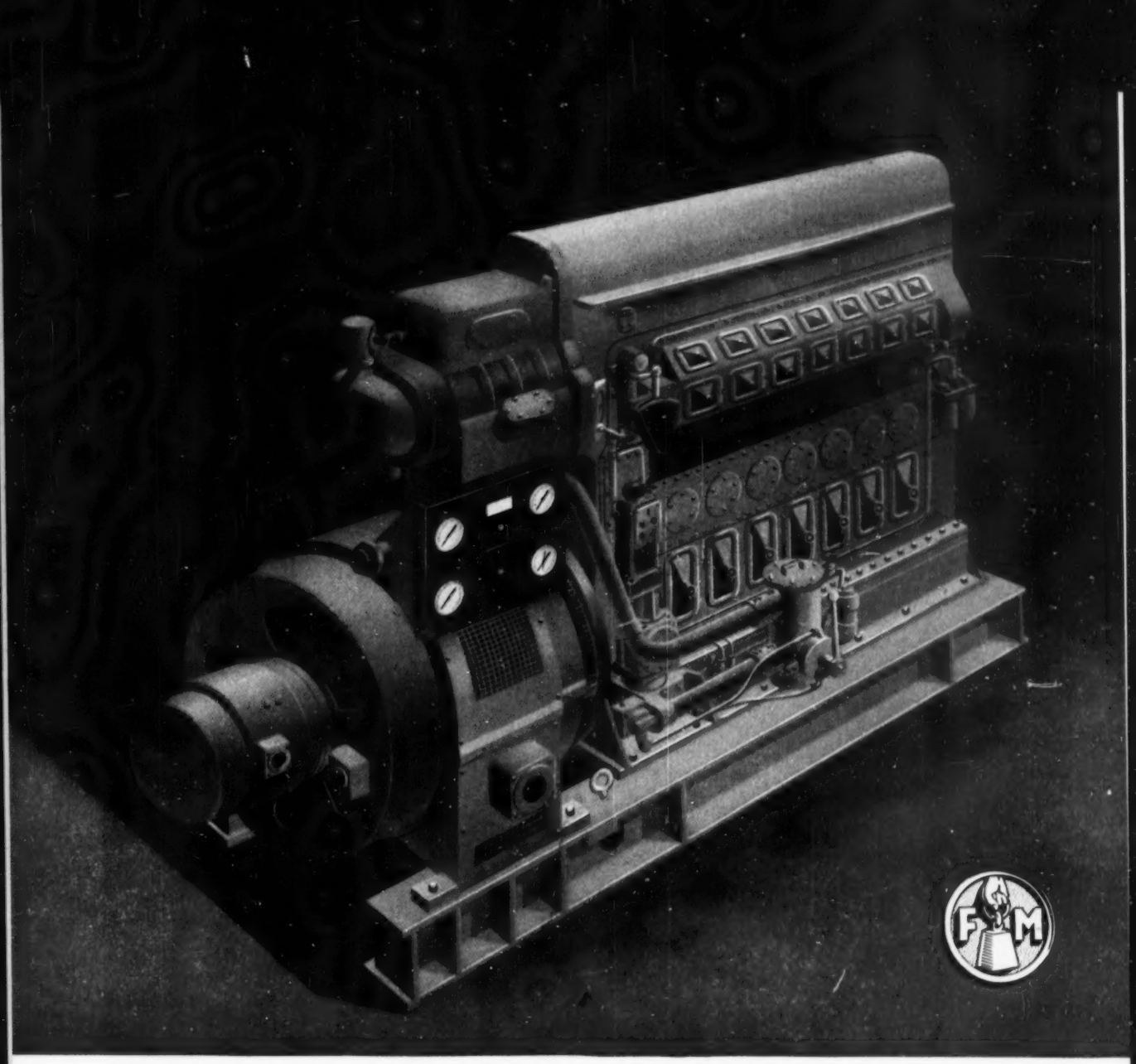
DELCO PRODUCTS

Division of General Motors Corporation, Dayton, Ohio

AC GENERATORS
20 kw through 150 kw at 1200 rpm
20 kw through 200 kw at 1800 rpm

DC GENERATORS
20 kw through 90 kw at 1800 rpm
20 kw through 75 kw at 1500 rpm
20 kw through 60 kw at 1200 rpm

SALES OFFICES:
ATLANTA • CHICAGO • CINCINNATI • CLEVELAND • DALLAS • DETROIT • HARTFORD • PHILADELPHIA • ST. LOUIS • SAN FRANCISCO



The Fairbanks-Morse Opposed Piston Diesel Model 38F 5¼. 225 to 750 horsepower.
Diesel Dual Fuel and Spark-ignition options.
Other O-P engines available in horsepower ratings to 2400.

. . . the price is more but the cost is less

You can buy many diesels for a little less than this Fairbanks-Morse OPPOSED PISTON Diesel . . . but no engine working at rated load can deliver power more reliably at less cost. The slightly higher price is quickly offset by the freedom from maintenance and service interruptions.

More engine hours of unfailing service mean fewer man-hours in maintenance and repair.

Fairbanks, Morse & Co., Chicago 5, Illinois

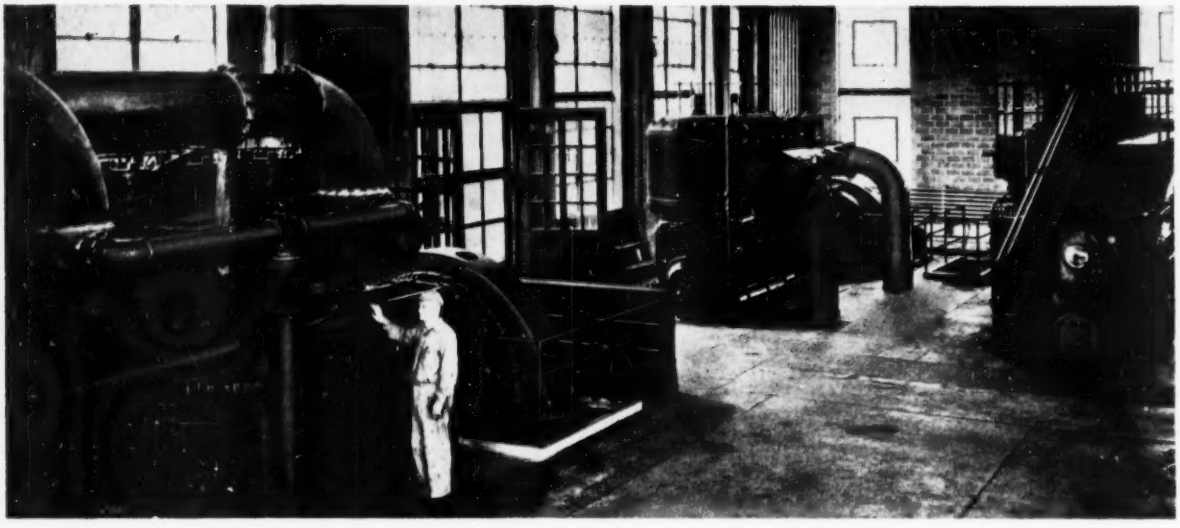
FAIRBANKS-MORSE

a name worth remembering when you want the best

DIESEL AND DUAL FUEL ENGINES • DIESEL LOCOMOTIVES • RAIL CARS • ELECTRICAL MACHINERY • PUMPS • SCALES • HOME WATER SERVICE EQUIPMENT • FARM MACHINERY • MAGNETOS

H. L. Ostness, Chief Engineer, River Falls Municipal Utility, Wisconsin, says...

"Sticking Rings are no problem in this Plant"



Mr. Ostness, as chief engineer of one of the oldest Municipal Power Plants in Wisconsin, knows diesels – *knows how to get the most out of them.* Mr. Ostness recently wrote, "We have used Sinclair Lubricants for over fifteen years very successfully. GASCON® and RUBILENE® H.D. have been doing an outstanding job in our diesels. Stuck rings is a trouble we know nothing about – engine wear is at an absolute minimum. With results like these, we'd recommend Sinclair Lubricants any time."

If your present lubricants do less, why not let Sinclair help you get longer life from your diesels – with less trouble. Contact your nearest Sinclair Representative or write Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR DIESEL LUBRICANTS

save wear and replacement

JUST A twist OF THE wrist

That's all it takes to clean the Cuno AUTO-KLEAN—the strainer that can be continuously cleaned while it's working.

Turning the handle one revolution moves the strainer element through comb blades, removing all dirt from strainer surfaces. Dirt particles fall to bottom of housing, where they can be drained off periodically. Cuno's exclusive combing operation cleans thoroughly—without costly interruption of fluid flow.

- AUTO-KLEAN's permanent metal filter element is available in steel, brass or stainless steel for long trouble-free service under any conditions.
- AUTO-KLEAN is adaptable to any fluid-flow system.
- From acids to tar . . . if you can pump it, Cuno can filter it. Capacities range from one gallon per hour to 3,800 gallons per minute.

A 3.8

CUNO **ENGINEERED FILTRATION**

Removes More Sizes of Solids From More Kinds of Fluids

AUTO-KLEAN (disc-type) • MICRO-KLEAN (fibre cartridge) • FLO-KLEAN (wire-wound)

AUTO-KLEAN GIVES EFFICIENT, FULL FLOW FILTRATION OF LUBE OILS

Permanent strainer element saves on maintenance bills

You can get full-flow filtration of your lube oil by sending all of it through Cuno AUTO-KLEAN strainers. AUTO-KLEAN's compact construction gives this full-flow fluid protection in space that would limit ordinary filters to by-pass service.

The low pressure drop of AUTO-KLEAN permits full-flow service on gravity or low-pressure lines, with no loss in operating efficiency.

Cuno's exclusive "comb-clean" action provides complete cleaning of the strainer element right on the job—with no need to disassemble filter. Thus, filter cleaning is not messy and creates no fire hazard.

AUTO-KLEAN saves on maintenance bills, too. There aren't any cartridges to change. An occasional rotation of the handle does a thorough cleaning job. (Most units can be equipped with motor drives for continuous cleaning.)

Fixed space metal discs in this modern strainer positively remove all solids larger than the specified disc spacing—from .0035" (170 mesh) up to .062" (12 mesh).

Find out how AUTO-KLEAN can protect your Diesel investment. Send the coupon today for free bulletin.

A.3.11

Cuno Engineering Corporation
Dept. 2511B South Vine St., Meriden, Conn.

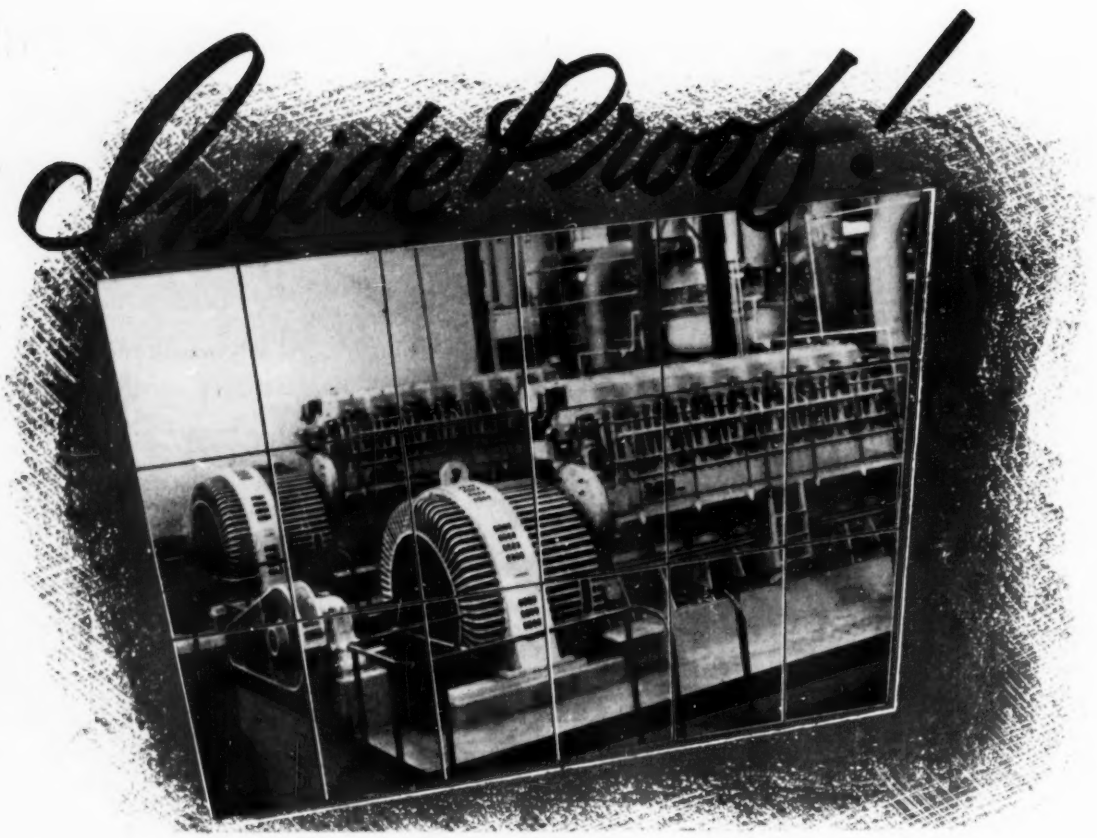
Please send me bulletin on Cuno AUTO-KLEAN for Diesel engine protection.

Name.....

Company.....

Address.....

City.....Zone....State.....



DIESEL GENERATION SHOWS MULTIPLE ADVANTAGE

In the famous Tupper, Placid and Saranac Lakes Region of the Adirondacks, Paul Smith's has coupled Diesel flexibility in strategic balance with its existing hydro-electric capacity, to supply firm power with unusual advantage.

As solved "from the inside out", the problem was to meet an annual growth in regular demand and still handle the peak loads imposed by an influx of vacationists during the summer period of lowest water.

There was also need for constantly available standby. Several large hospitals, including a huge Veteran's Hospital, are among Paul Smith's regular users.

Diesel generation offered extra advantages. It could be freely located, to provide power from both ends of the transmission system in case of line breaks. Its sensitive adjustment to load swing then replaced the hydro-electric lag. And line loss was minimized, resulting in an appreciable economy when the Diesel plant takes over peak loads.

"Inside proof" of these advantages — brought about by Paul Smith's careful pre-planning, to supply firm power despite summer influx and dry weather — is evident in company records of five years of increasing dependence on Diesel-electric generation. The highest point reached was during a 62-day period last summer, when the Diesel plant continuously supplied some 30 percent of base power.

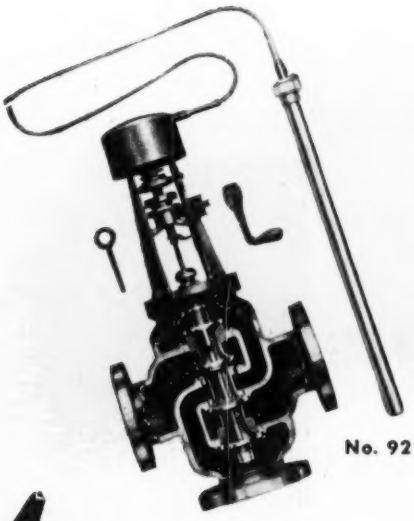
We think it significant that Paul Smith's, to meet these predetermined requirements, selected BALDWIN Diesels. Such an operator readily appreciates BALDWIN quality — and the fact that BALDWINS are factory-equipped with VAN DER HORST PORUS-KROME liners, for much longer service and efficiency.

VAN DER HORST

BALDWIN · BLH · LIMA-HAMILTON

BALDWIN - LIMA - HAMILTON
Hamilton, Ohio • *Sales Offices in Principal Cities*

VAN DER HORST CORPORATION
OLEAN, N. Y.



No. 923-3WB

No. 923-3

4 ways to protect your engines against trouble!

You need dependable automatic temperature control to guard internal combustion engines against possible costly damage and shutdowns. And these Sylphon Controls give you a choice to suit your requirements. For example:

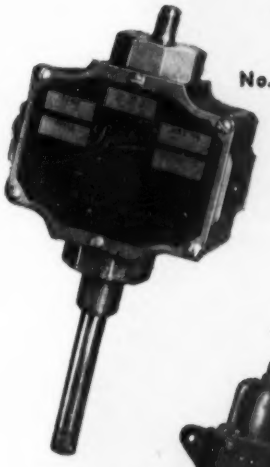
No. 539 Temperature-Pressure Switch automatically sounds an alarm . . . if water jacket temperature goes above, or lube oil pressure goes below safe limits. Or will flash a warning light . . . or if desired, shut down engine operation. "Fail-safe" feature.

No. 530 Safety Control automatically stops the engine . . . if cooling water temperature goes above, or lube pressure goes below safe limits. Will shut down small diesel engines direct and sound alarm, or serve as pilot valve to stop gas engines.

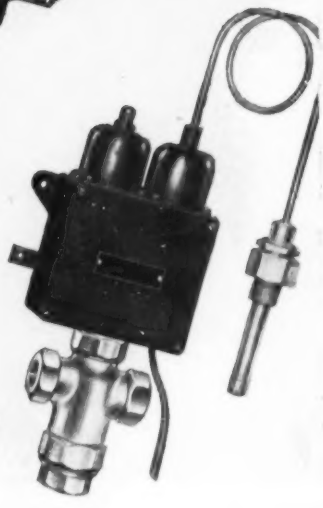
No. 923-3WB Regulator controls jacket water and/or lube oil cooling... for efficiency and low maintenance. Equipped with 3-way valve which is automatically positioned to direct all or part of cooling water through a by-pass . . . gives quick warm-up . . . improves performance. Can be manually operated, when desired.

No. 923-3 equipped with 2-way valve, otherwise same as No. 923-3WB.

Write for information about these rugged, dependable Sylphon Controls. Ask for Catalog VD-817.



No. 539



No. 530

Robertshaw-Fulton
CONTROLS COMPANY

FULTON SYLPHON DIVISION

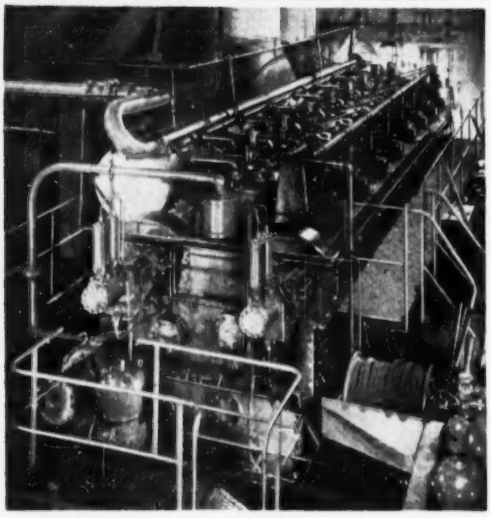
Temperature Controls · Bellows Devices · Bellows Assemblies

KNOXVILLE 1, TENNESSEE

Captain E. C. Baganz of M.S. Eugene W. Pargny reports:

"Our new Hamilton Diesel engine gives us enough added power and maneuverability to cut trip time 10%"

Here is Captain E. C. Baganz on the bridge of Pittsburgh Steamship's ore carrier M.S. Eugene W. Pargny which is shown below in service on the Great Lakes. It normally carries 14,000 long tons of ore from the head of Lake Superior to Lake Michigan or Lake Erie Ports and returns light.



Pictured above is the 2-cycle, 8-cylinder, single acting, direct reversible Hamilton Diesel engine which replaced a less efficient 2050-hp jet-condensing, triple-expansion steam engine in 1951.

Greater operating efficiency and maneuverability are two big advantages a Hamilton Diesel engine has given Pittsburgh Steamship during two years of service in their 600-foot ore carrier, Eugene W. Pargny. According to Captain E. C. Baganz, the 3570-hp, 21½ x 27½ Hamilton has made a "new ship" out of the 35 year old Pargny:

"MANEUVERABILITY is of prime importance to us, particularly when we must get the long, narrow ship through holes in breakwaters under severe, high wind storm conditions. The new Hamilton engine makes it a lot easier for us because it gives us more power ahead and astern.

"ECONOMICAL OPERATION of the Hamilton Diesel benefits us two ways. By substantially increasing our normal speed and maintaining a higher average speed it is enabling us to make more round trips to the ore fields per season compared with our previous average. Another advantage is the Hamilton Diesel's ability to burn any of the heaviest fuel oils. Except for short periods when starting or maneuvering in close quarters, this engine has been burning heavy residual fuels without unusual difficulty."

HAMILTON DIVISION, Hamilton, Ohio

BALDWIN-LIMA-HAMILTON

*Could you make this report about your diesel engine?**

CITY OF BESSEMER, MICHIGAN REPORTS:

Nordberg Diesel engine used by Bessemer, Michigan Municipal Power Plant.

PISTONS PULLED AT 24,600 HOURS!

- All rings were free
- No carbon in ring grooves
- All original rings replaced in original grooves
- Rings should last at least 10,000 more hours
- Maximum cylinder wear was .004 at top, .002 at bottom

OIL CHANGE AT 5000 HOURS!

- No oil added to crankcase between changes
- Power cylinders fed at rate of 5 drops per minute
- Main bearing, rod bearings show very little wear
- Average K.W. per gallon of fuel is 13.5 @ 60% load factor

EXCELLENT

Sam Kalember

Superintendent,
Bessemer Light Utility.

Note:

FOR TOP ENGINE EFFICIENCY, BESSEMER RELIES ON:

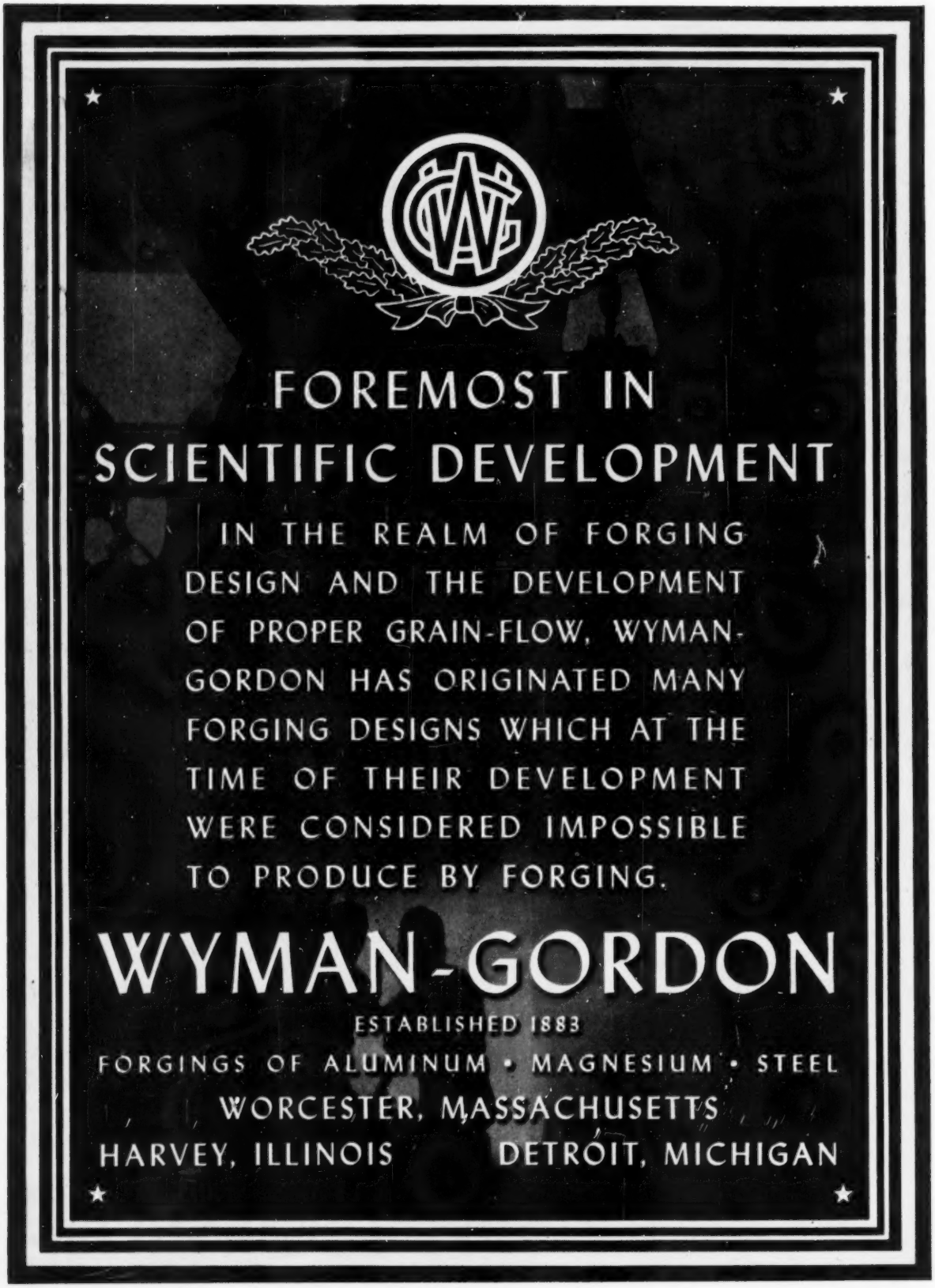
Cities Service DC-930 Oil used for crankcase lubrication!

Cities Service DC-230 Oil used for power cylinder lubrication!

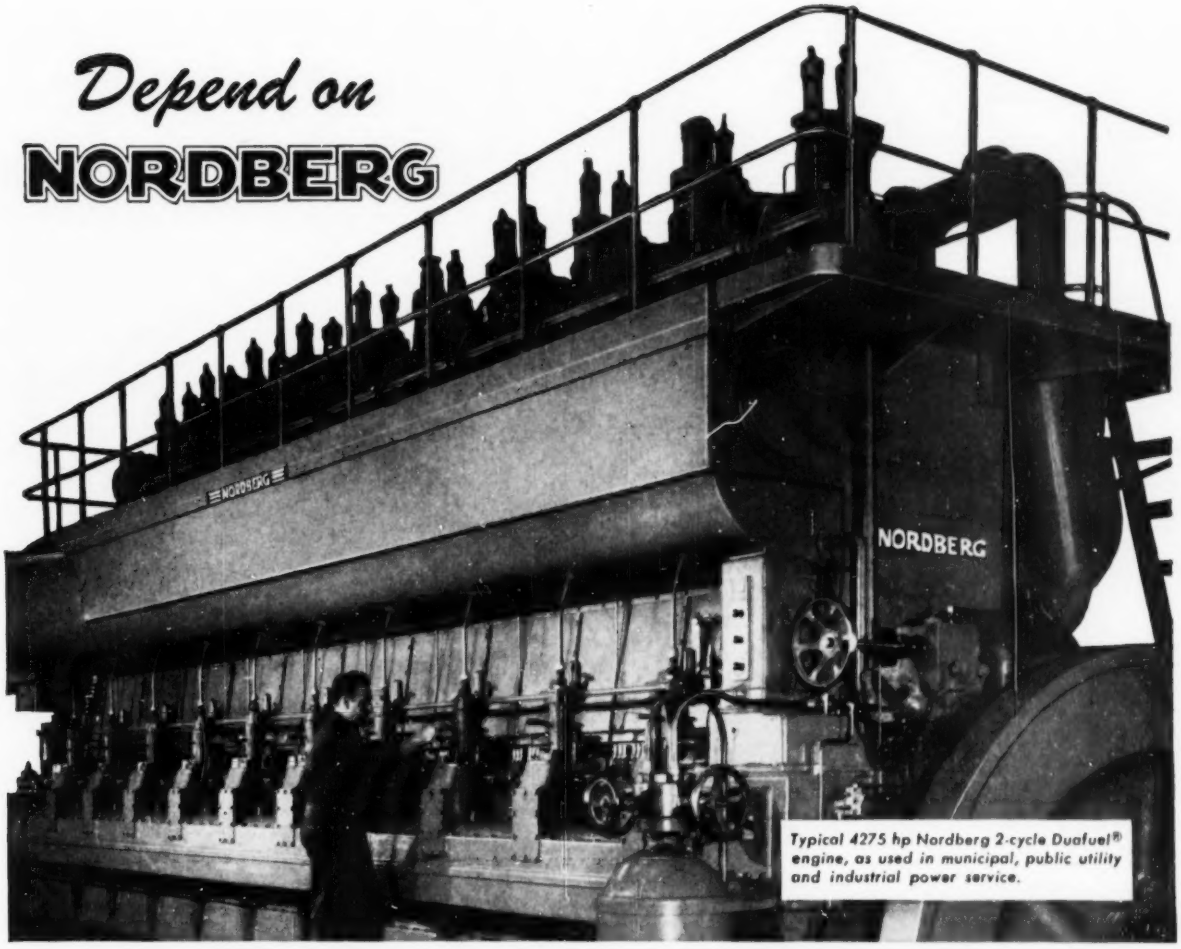
* Why not contact your nearest Cities Service Representative or write Cities Service Oil Company, Dept. K7, Sixty Wall Tower, New York City 5, New York.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS


FOREMOST IN
SCIENTIFIC DEVELOPMENT
IN THE REALM OF FORGING DESIGN AND THE DEVELOPMENT OF PROPER GRAIN-FLOW, WYMAN-GORDON HAS ORIGINATED MANY FORGING DESIGNS WHICH AT THE TIME OF THEIR DEVELOPMENT WERE CONSIDERED IMPOSSIBLE TO PRODUCE BY FORGING.
WYMAN-GORDON
ESTABLISHED 1883
FORGINGS OF ALUMINUM • MAGNESIUM • STEEL
WORCESTER, MASSACHUSETTS
HARVEY, ILLINOIS
DETROIT, MICHIGAN

Depend on
NORDBERG



Typical 4275 hp Nordberg 2-cycle Duafuel® engine, as used in municipal, public utility and industrial power service.

for the BEST in Modern Diesel Power

Here are 6 reasons why:

1. BUILT-IN DEPENDABILITY
Heavy duty construction unmatched for long life and trouble-free operation.

2. UNEQUALLED EXPERIENCE
Heavy machinery builders since 1890, Nordberg produces America's largest line of heavy duty Diesels.

3. ECONOMICAL AT ALL LOADS
Controlled fuel injection assures maximum fuel economy.

4. CONTROLLED POWER
Instantaneous response to changing load conditions.

5. COMPLETE ACCESSIBILITY
Simplicity of design and construction makes all parts readily accessible.

6. LOW MAINTENANCE
Advanced engineering results in less maintenance cost per kilowatt-hour.

Nordberg Engines are now built in sizes from 10 to over 10,000 horsepower in a single engine . . . including Diesel, Duafuel® and Spark-Fired Gas Burning types.

When you think of POWER—think of NORDBERG. Write for further details, outlining your power requirements.

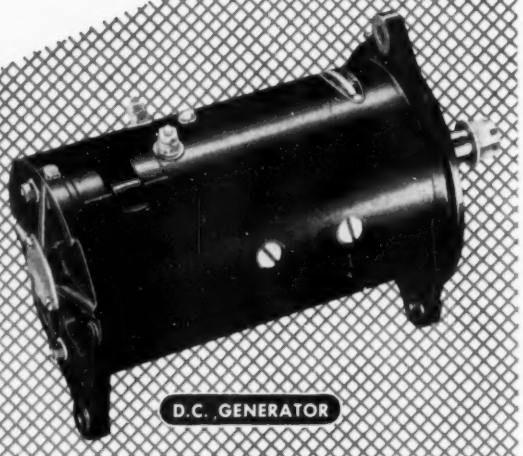
NORDBERG MFG. CO., Milwaukee, Wis.

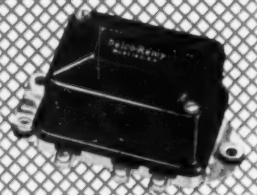
P353

BUSCH SULZER
A DIVISION OF NORDBERG

NORDBERG
DIESEL ENGINES

Right for the Job!





DELCO-REMY HEAVY-DUTY 5⅝" DIAMETER GENERATORS AND MATCHING REGULATORS

Delco-Remy heavy-duty 5⅝" diameter generators have made a name for themselves with Diesel users who need units that develop full output at low speeds on governed Diesel engines. These Delco-Remy generators have exceptionally long brush life (100,000 miles or more is common) and, because of their durable construction and simple, dependable lubrication system, require a minimum of maintenance.

Heavy-duty features include an extra-heavy, rigid armature shaft, extra-large brushes and commutator, ball bearings in both commutator and drive end frames, wick-type lubrication with oilers, and forced ventilation.

These generators, with a frame diameter of 5⅝ inches, are available in 6-, 12-, 24- and 32-volt models. Six-volt models have capacities as high as 55 amperes, 12-volt models as high as 50 amperes. The 24- and 32-volt models provide outputs of 20 and 15 amperes, respectively. Matching regulators are available for all models. Specify Delco-Remy heavy-duty generators with mounting brackets and pulleys when ordering new vehicles.

DELCO-REMY
Division, General Motors Corporation
Anderson, Indiana

WHEREVER WHEELS TURN OR PROPELLERS SPIN

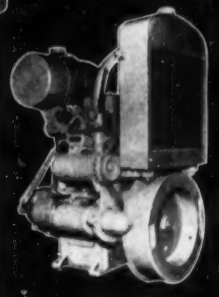
13 HP, V Type air cooled Hallett Diesel with 20-1 compression ratio.

WHAT'S YOUR APPLICATION ? ? ?

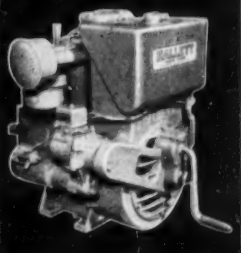
Original equipment manufacturers everywhere are depending upon Hallett, the leader in lightweight, economical, dependable, Diesel engines. Find out for yourself how a Hallett can add customer appeal to your product and give added years of trouble free dependable Diesel service.

Sales and service throughout the world.

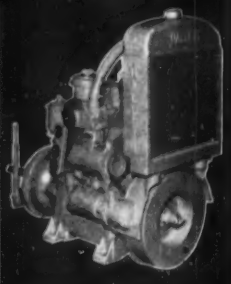
District Sales Offices: Washington, D.C., 13th and E Streets; Detroit, Mich., Book Tower Bldg.; New York, N. Y., Grand Central Bldg.; Chicago, Ill., 600 So. Michigan Blvd.



8 HP @ 1500 RPM, dependable, single cylinder, water cooled Hallett Diesel used throughout the world.



5 HP @ 1800 RPM, lightweight, air cooled Hallett Diesel weighs less than 240 pounds.



18 HP, water cooled unit preferred by original equipment manufacturers and foreign buyers everywhere.

HALLETT MANUFACTURING COMPANY

1603 West Florence Avenue • Inglewood, California

My application is_____

Please send me full details on the Hallett Diesel Engines.

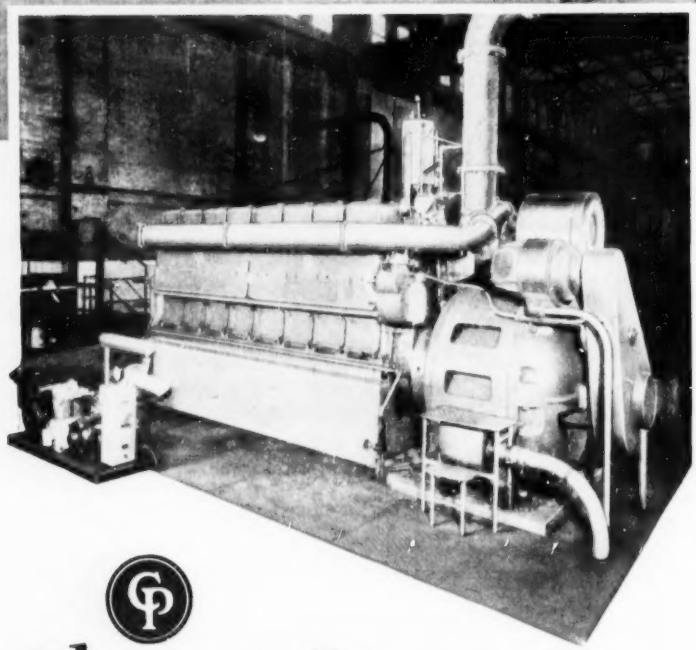
Name_____

Firm Name_____

Address_____

City_____ Zone____ State_____

PERFECT "STAND-IN" WHEN POWER FAILS



When an emergency strikes, cutting off power in your plant, you can resume production immediately with a CP Standby Power Unit, eliminating losses caused by spoilage of materials and idle labor during power failures.

CP Diesel, Dual Fuel or Gas Engine Units in portable and stationary models are available in sizes capable of delivering 120 HP to 1750 HP and in normally aspirated or supercharged models. For more details, write: *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, N. Y.*

Chicago Pneumatic

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

FREE help for Diesel owners who want to cut costs!

give us a pint of your used oil

We will send it to our modern laboratory for a free Pure-Sure Analysis. This analysis tells . . .

—if the engine it came from is using too much oil or fuel. And usually why.

—whether or not the oil filter is working efficiently.

—whether or not you might well change oil more frequently or less frequently than you do.

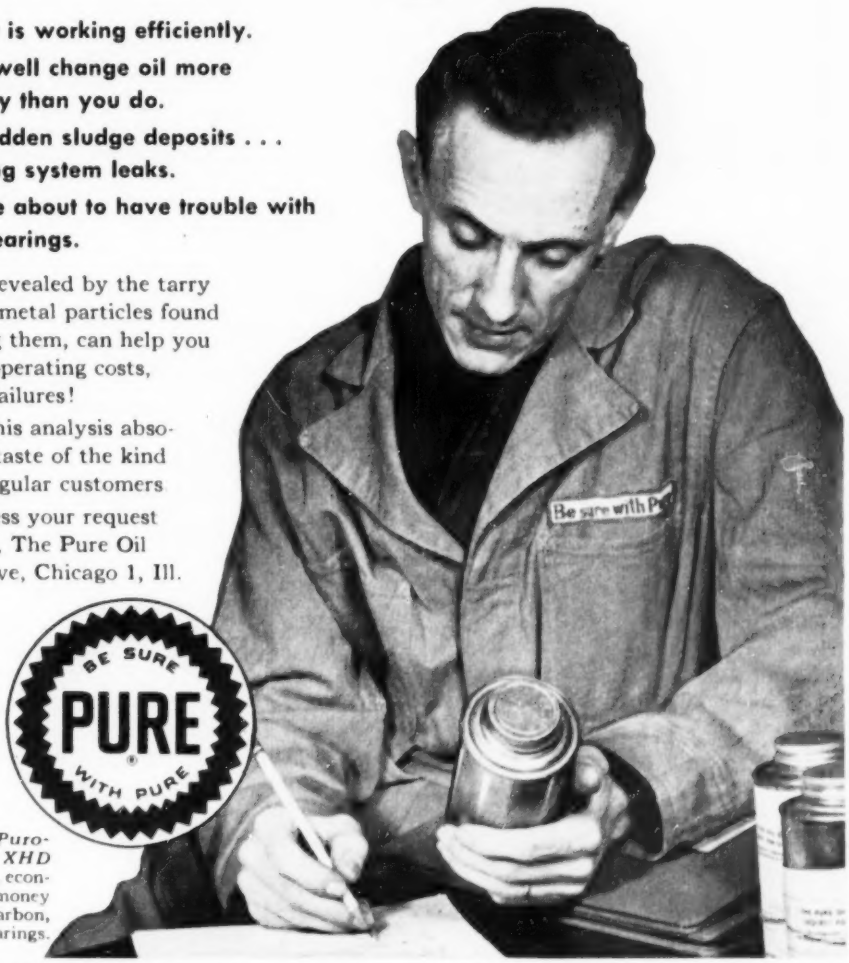
—whether or not there are hidden sludge deposits . . . varnish deposits . . . cooling system leaks.

—whether or not you may be about to have trouble with the rings. Or pistons. Or bearings.

Secrets like these actually are revealed by the tarry materials, fuel, water, dirt and metal particles found in used motor oil. And knowing them, can help you improve engine efficiency, cut operating costs, and detect threatening engine failures!

Pure Oil wants to give you this analysis absolutely free—just to give you a taste of the kind of service received by all our regular customers

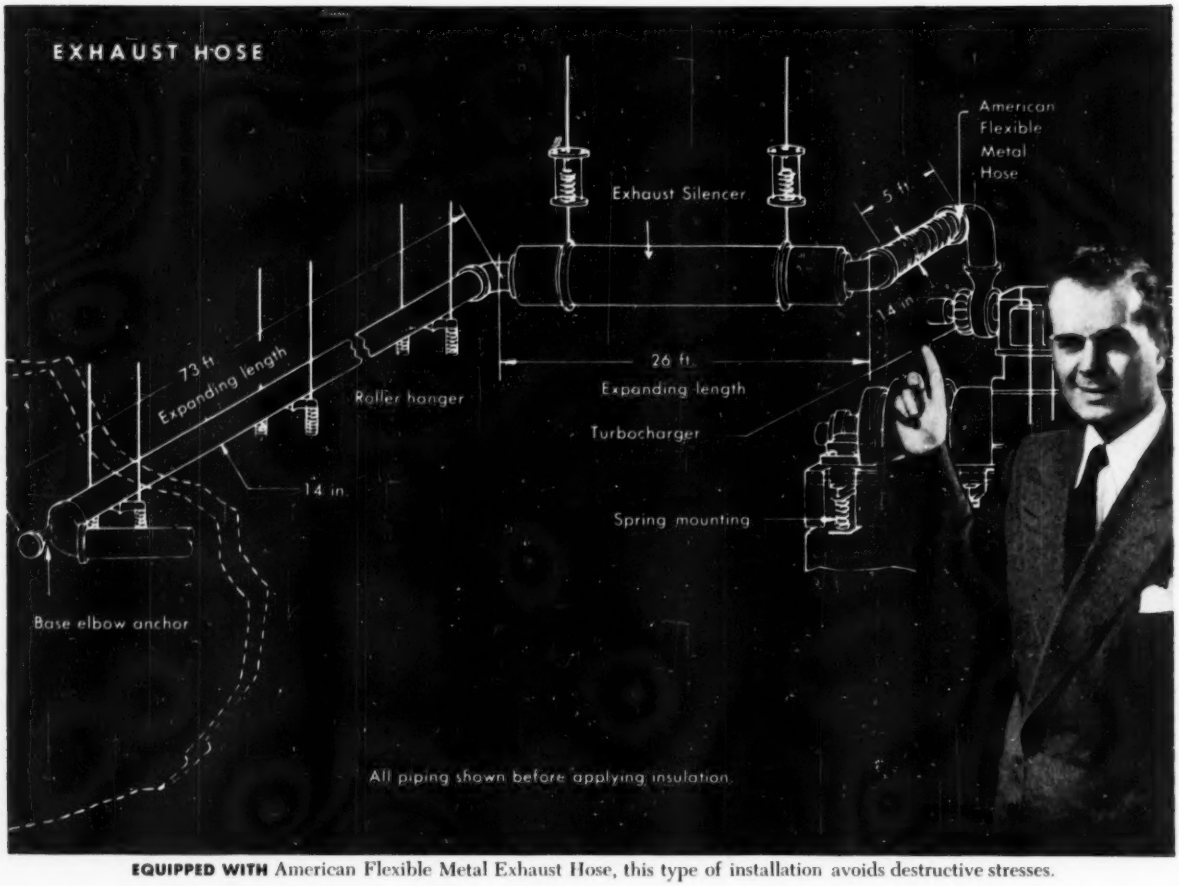
There is no obligation. Address your request to Dept. D-32, Industrial Sales, The Pure Oil Company, 35 East Wacker Drive, Chicago 1, Ill.



Be sure with Pure

Pure Oil's *Klondyke*, *Purodiesel*, *Purodiesel XD*, *Sultana X* and *Sultana XHD* oils keep Diesel engines clean, efficient, economical—give you the most for your money in the way of *sure* protection against carbon, sludge, stuck rings and corroded bearings.

***Sales offices located in more than 500 cities, including:** Atlanta • Birmingham • Charleston • Charlotte • Chattanooga • Chicago Columbus • Indianapolis • Jacksonville • Madison • Memphis • Miami • Milwaukee • Minneapolis • Pensacola • Pittsburgh • Richmond



EQUIPPED WITH American Flexible Metal Exhaust Hose, this type of installation avoids destructive stresses.

Exhaust system for a spring-mounted diesel

Here, flexible steel exhaust hose takes up expansion in the piping . . . isolates engine vibration . . . makes maintenance easier

Shown above is one method of arranging exhaust piping for a spring-mounted diesel engine. Notice that the exhaust system includes a flexible connection and is suspended on spring rollers. In this type of installation, flexible steel exhaust hose does 3 jobs:

(1) *It frees the engine turbocharger casing from strains caused by the expansion in two directions of the long exhaust line.*

(2) *It reduces the transmission of vibration caused by the oscillation of the engine on its spring mounting.*

(3) *It simplifies disassembly of the turbocharger.*

To these and other problems involved in installing exhaust piping, American Flexible Steel Exhaust Hose offers an easy solution. Because it is *flexible*, it "gives" when vibrations occur and when temperature changes expand and contract piping.

This hose can prevent expensive breakdowns which result when rigid piping systems "work" and overstress flange bolts. It relieves strain on engine castings . . . keeps exhaust lines tight. Offset connections and misalignment are easily solved. Installation is quick and economical. No costly pipe bends are needed. Once this hose is installed, you're sure of years of trouble-free service.

American Flexible Steel Exhaust Hose for exhaust and air intake—marine or industrial diesels—is available in corrugated steel, 2 in. to 16 in. I.D. inclusive. Want more information? Write for Bulletin EH-50-1 to: *The American Brass Company, American Metal Hose Branch, Waterbury 20, Conn. In Canada: The Canadian Fairbanks-Morse Co., Ltd.* 53232

OTHER PRODUCTS FOR DIESEL USE: Flexible tubing with wire braid covering for: starting air, circulating water, fuel oil, lubricating oil. Tubing available in bronze, carbon and stainless steel. Assemblies complete with fittings.

WHEREVER CONNECTORS MUST MOVE

AMERICAN

flexible metal hose and tubing

An ANACONDA® Product

more horsepower a problem?

less weight per horsepower a problem, too?

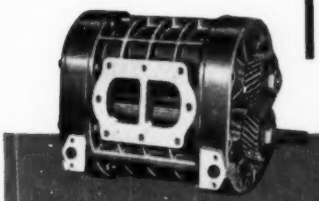
There's an easy way to keep pace with the race for more engine horsepower . . . without adding weight per horsepower, without sacrificing valuable space. *Specify Miehle-Dexter Superchargers.* You'll register a big gain in horsepower—up to 50% or more—and the additional investment in equipment will be far less by comparison with other methods.

And when you put M-D Superchargers on your engines you're assured of efficient operation plus long life and low maintenance service. Exclusive M-D features make this possible. Result: dividends in fuel economy and maintenance costs.

On small jobs as well as large, M-D engineers will be glad to work with you—to help you get the exact size and type of supercharging equipment for your purpose. Write for technical brochure with specifications and performance data.

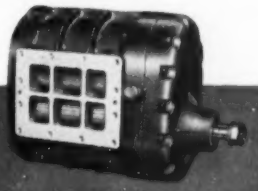
MIEHLE-DEXTER SUPERCHARGERS

are engineered to match your exact requirements



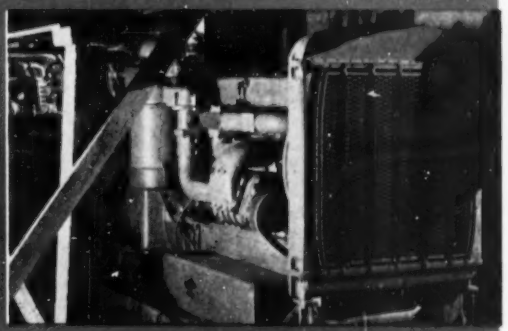
Typical direct driven, flange mounted M-D Supercharger. Develops 350 c.f.m. at 10,000 r.p.m. Other models with capacities to 4,000 c.f.m. available.

Direct driven, port mounted, Model 27100. Maximum 920 c.f.m. at 7000 r.p.m.



Belt driven, port mounted Model 5511 develops 1250 c.f.m. at 4000 r.p.m.

Supervisors at an Arizona pit mine report big, fast-moving M-D supercharged Diesel trucks climb stiff grades with power aplenty . . . sharply cut maintenance costs in moving overburden.



Supercharged Diesel power pays off in the crushing plant. The M-D Supercharger puts more horsepower in the engine . . . reduces weight per horsepower by 20%. Easier portability.

MIEHLE-DEXTER SUPERCHARGER

DIVISION OF THE DEXTER FOLDER COMPANY

100 FOURTH STREET • RACINE, WISCONSIN

The Indispensable Diesel Reference Book

New Comprehensive

DIESEL ENGINEERING HANDBOOK

Eighth Edition Completely Revised
18th Year—8th Edition—40,000 copies of previous editions in use
Now Bigger and Better Than Ever Before

●

DIESEL Technology in its most Readable and Understandable Form on Stationary, Locomotive, Automotive, Marine and Industrial Diesels and Dual Fuel Engines.

Bigger . . . Better . . . More Valuable

NO Price Increase

This book is as essential to all diesel men as the diesel engine is to power.

This book is the biggest help ever published for every diesel man from designer to operator—oldtimer to student beginner in diesel work.

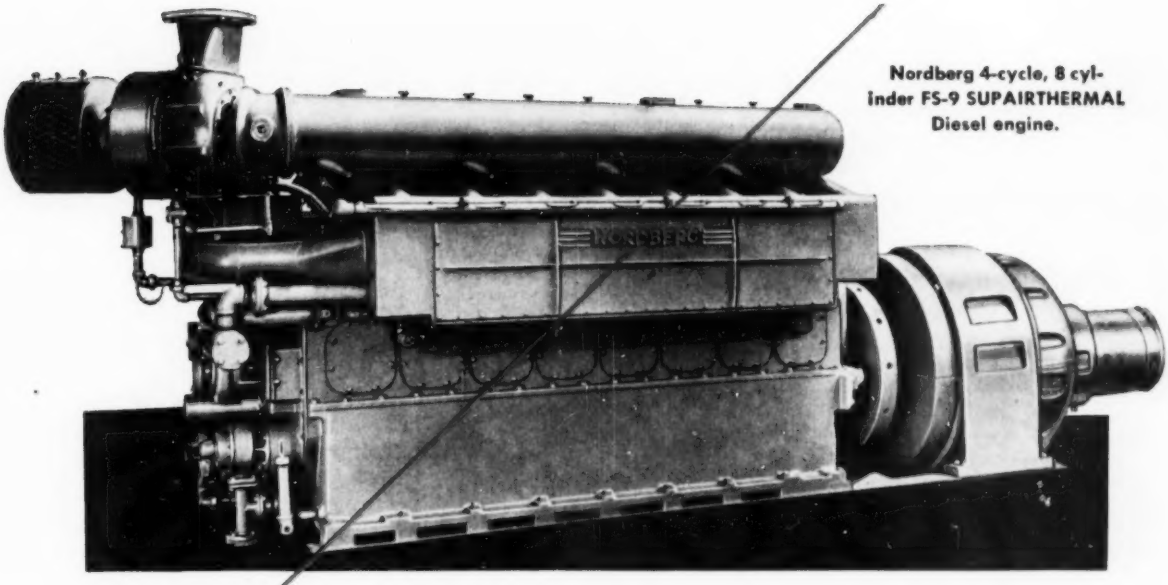
Design, construction, installation, operation, maintenance and repair of diesels and every kind of equipment appear in this great volume.

Fuels and fuel systems—lubricants and lubrication—coolants and cooling, all fuel injection pumps and injectors—accessories and diesel equipment of all kinds [illegible] installation, use and maintenance.

Nothing is left to the imagination of the reader. The operator of one of the largest diesel schools in the U. S. A. once said, "With that DIESEL ENGINEERING HANDBOOK you run the biggest diesel school in the country". Now you get more text, more subjects, more illustrations, complete engine descriptions and full diesel specifications all for the same old price—Only $7.50. So new that the ink is "still wet"!

Order your copy today from the world's leading publisher of Diesel Magazines and Books.

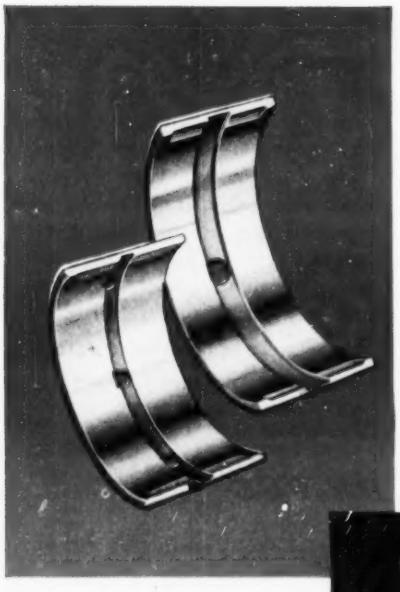
DIESEL PUBLICATIONS, INC.
192 Lexington Avenue New York 16, N. Y.



Nordberg 4-cycle, 8 cylinder FS-9 SUPAIRTHERMAL Diesel engine.

a world-wide reputation for Dependable Service and Nordberg uses Dependable

FEDERAL-MOGUL BEARINGS



Sleeve bearings in a wide range of designs and sizes; cast bronze bushings; rolled split-type bushings; bimetal rolled bushings; washers; spacer tubes; precision bronze parts and bronze bars.

Producers of America's largest diesels, Nordberg builds with skill and experience. Big, powerful, dependable in service, Nordberg engines are famed from Milwaukee to Madagascar, from St. Louis to Singapore.

Federal-Mogul crankshaft and connecting rod bearings equip Nordberg's 9-, 13- and 16-inch bore engines. Helping put power to work *smoothly*, through silent sleeve bearings, has been a Federal-Mogul specialty since 1899.

FEDERAL Mogul

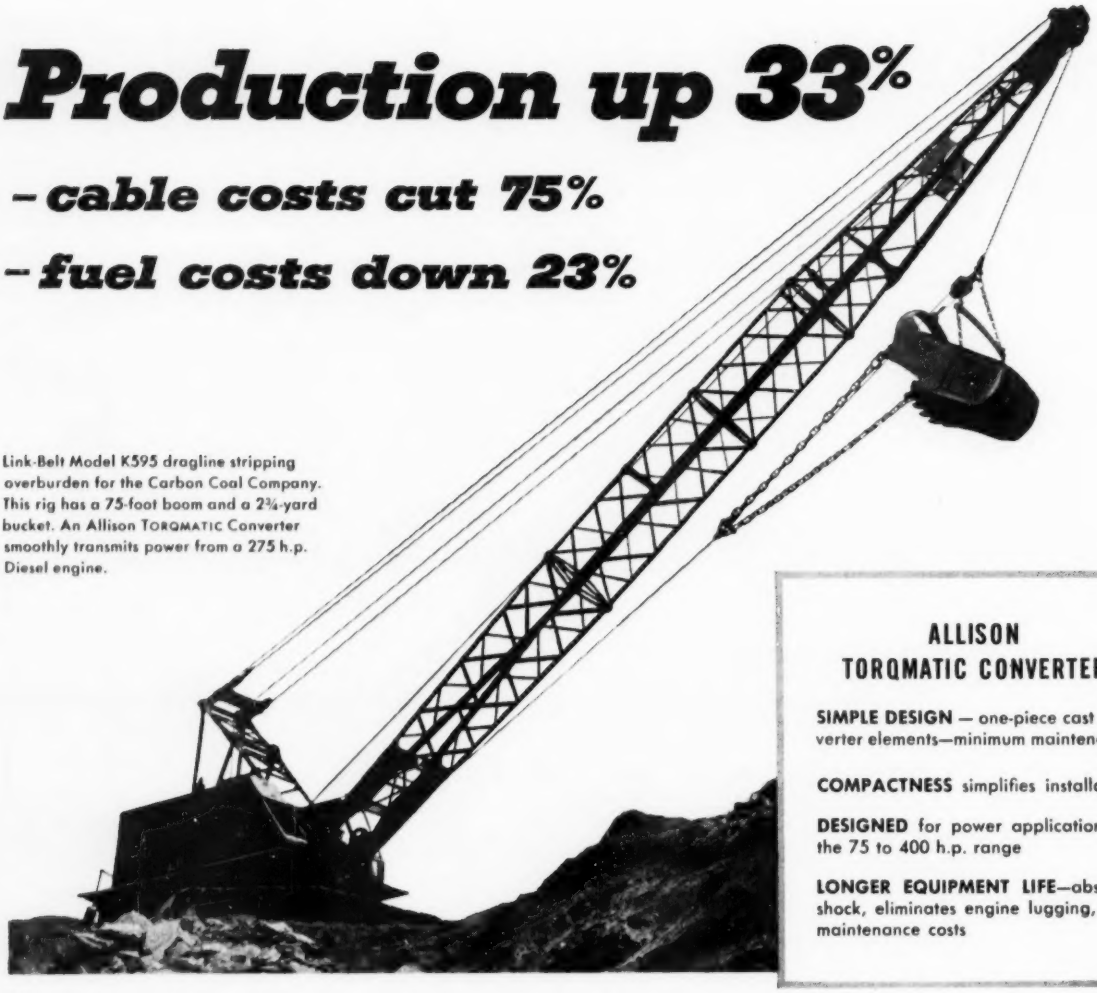
FEDERAL-MOGUL CORPORATION • 11041 SHOEMAKER AVENUE
DETROIT 13, MICHIGAN

FEDERAL-MOGUL

Production up 33%

– cable costs cut 75%

– fuel costs down 23%



Link-Belt Model K595 dragline stripping overburden for the Carbon Coal Company. This rig has a 75-foot boom and a 2¾-yard bucket. An Allison TORQMATIC Converter smoothly transmits power from a 275 h.p. Diesel engine.

ALLISON TORQMATIC CONVERTER

SIMPLE DESIGN — one-piece cast converter elements—minimum maintenance

COMPACTNESS simplifies installation

DESIGNED for power applications in the 75 to 400 h.p. range

LONGER EQUIPMENT LIFE—absorbs shock, eliminates engine lugging, cuts maintenance costs

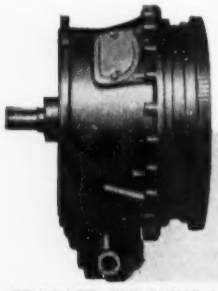
Here's another operator who's boosting production and cutting costs with Allison TORQMATIC DRIVES: The Carbon Coal Company operates two Link-Belt draglines, strip-mining coal near Grove City, Pa. The units are nearly identical—one has an Allison TORQMATIC Converter, the other is direct-driven—but there's a big difference in operating costs and production.

The Allison Converter absorbs shock loads so dragline cable on the TORQMATIC-equipped unit lasts four times as long, *saving $2160 a year on cable alone*, a reduction of 75%.

The TORQMATIC-equipped unit strips a 60x40x25 foot "lift" of overburden in 24 hours against 32 hours for the direct-driven unit, a 33% increase in production. A comparison of daily fuel records shows the friction drive unit consumes 130 gallons while the Converter-equipped unit uses only 100 gallons, a cut in fuel costs of 23%.

The TORQMATIC-equipped unit has rolled up such an impressive performance record that this operator intends to specify TORQMATIC DRIVES in all his new heavy-duty equipment. You, too, can cut your costs by specifying Allison TORQMATIC DRIVES the next time you buy. Ask your equipment dealer, manufacturer or write:

ALLISON DIVISION OF GENERAL MOTORS
Box 8945S, Indianapolis 6, Indiana



Allison **TORQMATIC DRIVES**

GM GENERAL MOTORS

COMPACT, EFFICIENT HYDRAULIC DRIVES FOR CRANES * TRUCKS * TRACTORS * SCRAPERS * SHOVELS * DRILLING RIGS

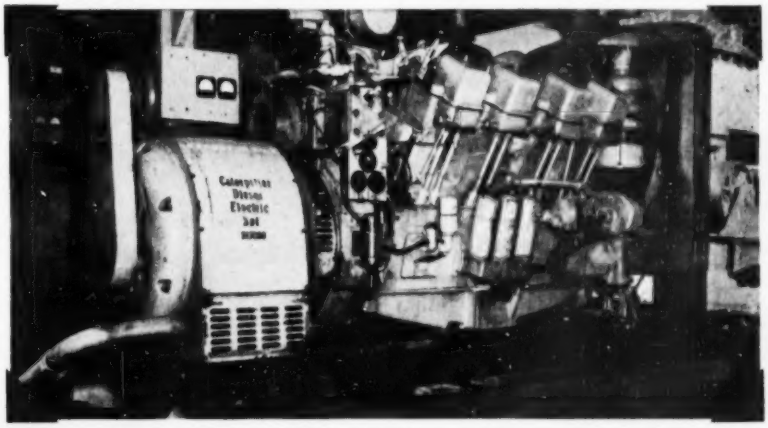
THE ENGINEER'S REPORT

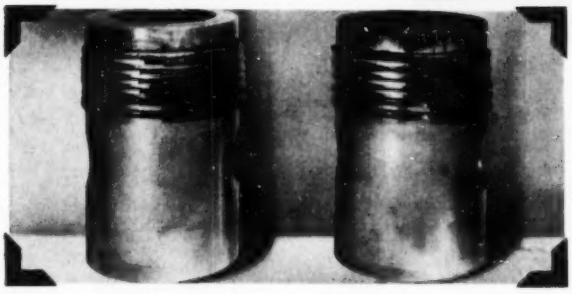
DATA

LUBRICANT	RPM Delo Supercharged-2
UNIT	D17000 diesel engine
OPERATION	Constant operation in extreme temperatures
PERIOD	9277 hours
FIRM	Diamond Lumber Co., Glenwood, Oregon

Diesel engine "spotless" after 9,277 hours of work!

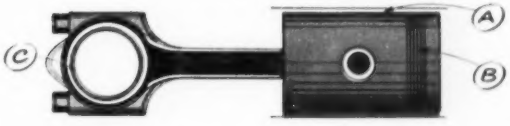
THIS D17000 DIESEL ENGINE worked 17 hours per day in weather that varies from below zero to over 100 degrees. Lubricated with RPM DELO Supercharged-2 Lubricating Oil since installation, it was inspected after 9,277 hours of operation. The engine looked as though it had just been thoroughly cleaned —"spotless" according to the engineer on the job. This is one of six D17000 Cats which was used to supply power for Diamond Lumber Company's mill at Lee's Camp, Oregon. This mill cuts approximately 100,000 board feet of Douglas fir per day.





REPRESENTATIVE PISTONS, exactly as they came from engine after 9,277 hours, show cleanliness of all parts. Wear at top of cylinder liners miked only 0.0015 inch! Con rod and main bearings were all good; valves and valve seats were in excellent condition. The RPM DELO Lubricating Oil in this engine was changed at regular intervals.

How RPM DELO Oils keep engines clean and prevent wear



A. Contain special additives that provide metal-adhesion qualities...keep oil on parts whether they are hot or cold, running or idle.

B. Anti-oxidant resists deterioration of oil and formation of lacquer...prevents ring-sticking. Detergent keeps parts clean, helps prevent scuffing.

C. Special compounds stop corrosion of any bearing metal, and oil foaming in both wet and dry sump engines.

There is an RPM DELO Oil to meet every heavy-duty engine operating condition.

FREE BOOKLET on the RPM DELO Oils gives you complete information. Write or ask for it today.

RPM DELO LUBRICATING OILS

FOR MORE INFORMATION about this or other petroleum products of any kind, or the name of your nearest distributor handling them, write or call any of the companies listed below.

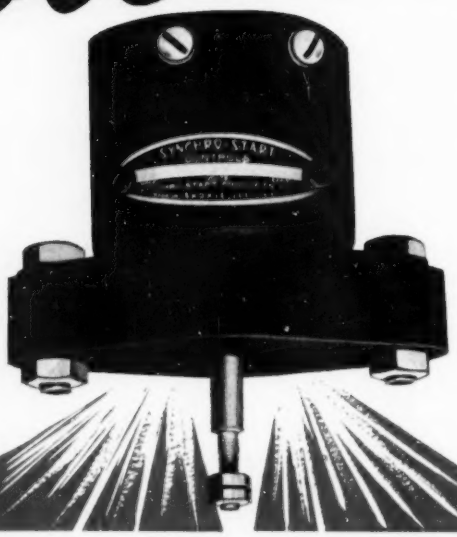
TRADEMARK "RPM DELO" REG. U.S. PAT. OFF.

STANDARD OIL COMPANY OF CALIFORNIA, San Francisco 20 • STANDARD OIL COMPANY OF TEXAS, El Paso
THE CALIFORNIA OIL COMPANY, Barber, New Jersey • THE CALIFORNIA COMPANY, Denver 1, Colorado

Continuous Duty

FOR DIRECT CURRENT ONLY

Solenoids



The Synchro-Start Solenoids are small and ruggedly constructed in a dust and splash proof case. They are used for operating throttles, fuel pump racks, chokes, anti-dieseling devices and controls.

Technical Data

Dimensions—4½" x 3⅞" Voltages—6, 12, 24 and 32

Shipping Weight—3 pounds 10 pound pull with ½" stroke

Current Consumption—220 W pulling, 6.5 W holding

Either grounded or ungrounded

For further information ask for **BULLETIN 410**

SYNCHRO-START PRODUCTS, INC.

Automatic Engine Control Equipment

8131 N. RIDGEWAY AVE. • SKOKIE, ILLINOIS

Editorially Speaking . . . .

What About Tariffs?

JUST about every morning you see in the papers that someone else has joined the movement pointed toward the general lowering of tariffs in order to stimulate freer international trade. It is proposed as an implementation of the "Trade not Aid" philosophy for dealing with our alllies of the free world. Free enterprise and the competitive system; buy from them so that they can get dollars to buy more from us.

From the broadest of viewpoints (and if it works), it sounds swell and in line with the leadership responsibilities that have been thrust upon us. It certainly appears to offer attractive possibilities.

Great industrialists, possibly anticipating the day when their production far exceeds domestic consumption capabilities, are urging it as are some of their representative Associations. The traditionally high-tariff Administration is reportedly studying the matter.

It is a complex and serious proposition that must be settled at the highest levels. If put into effect there will necessarily be realignments and adjustments in our economy. Someone is bound to be hurt. If you are one of that minority, human nature being what it is, you will accept the broad and ideological explanations with the same mental reservations that your kid does when you insist that you are only spanking him for his own good.

Slipping into a comfortable old cliche, we might say, "This thing is bigger than all of us". Whether we like it or not, we as an industry may not be able to do much about it; we might be caught in a tide of national decision and carried along.

So let's get an idea of where we would stand if the protection of tariff barriers were reduced or removed. It resolves to two problems: what of the domestic competitive situation? and what of the effect on our export market?

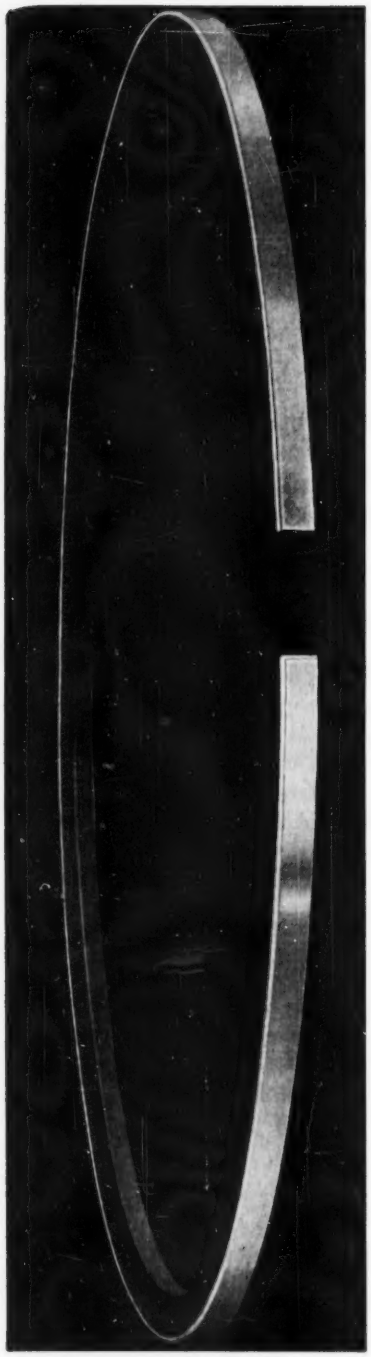
Despite import duties and transportational costs, a relatively small number of foreign engines in some sizes are being sold here at a slight price advantage. This margin might be increased, providing that original costs remain the same. But part of the "grand plan" is to increase standards of living abroad, which inevitably means higher labor cost and a narrowing of this price advantage.

On our credit side is the fact that our engines have been developed with our applications in mind and are thus well suited to our needs. Also, sales and service organizations have been developed on a nationwide basis and this is extremely important in view of our American concepts of service. Thus we have quite a jump on any competition that would have to develop similar facilities.

Talking to people in export departments, we find that their biggest obstacle to sales is the lack of or unwillingness to spend dollars. Apparently they have no fears concerning technical competition. Given an increase in dollar purchasing power abroad, they are optimistic.

Currently, foreign aid dollars are being used for shopping in "soft" currency areas for better prices. Then, there is the two-price system wherein many foreign engines for export are not taxed as highly as those for domestic consumption. Such practices should be taken into account in setting tariffs, or perhaps some tax relief should be granted on our export engines. There is already talk of a two-price system for farm commodities.

Granted that these are generalizations, it would appear that we have little to fear whichever way the cat jumps. We have a tradition of competition and do not fear it, providing that all play under the same rules. If there is to be some change, that is the point for major effort—to see that equitable rules are set forth.



Chrome-Faced Cyclan Ring

high-strength

heat-treated

resilient

long-wearing

Cyclan

offers a combination of advantages not found in any other piston ring material

Sealed Power's new alloy for extreme operating conditions

Developed by Sealed Power metallurgists after years of experimenting and testing, Cyclan has strength approaching steel, resilience and life-expectancy exceeding cast iron, yet it retains the desirable bearing characteristics of cast iron. Cyclan has exceptional ability to retain these physical properties under extreme operating temperatures.

Cyclan piston rings are especially durable in super-charged engines. They have extraordinarily high impact value for shock resistance. Because of Cyclan's high resilient qualities, Cyclan rings retain their true shape even after considerable deflection.

Available now

Cyclan can be readily chrome plated, but it functions very efficiently without any plating.

Cyclan is available for original equipment piston rings in heavy duty engines. Some Sealed Power Cyclan Ring Sets are available for replacement now. Others will follow soon.

Let our engineers tell you the Cyclan story!

SEALED POWER CORPORATION
MUSKEGON, MICHIGAN

Sealed Power

PISTON RINGS · PISTONS
CYLINDER SLEEVES

+ HIGHLIGHTS +

● From November 29 to December 4, 1953, the American Society of Mechanical Engineers will hold its annual meeting at the Hotel Statler and Hotel McAlpin in New York City.

● As of October 1, 1953, Class I railroads had 548 new locomotive units on order of which 520 were diesel-electric, 3 steam, 10 electric, and 15 gas-turbine-electric.

● This is the first time since the beginning of the American Trucking Association's national truck roadeo in 1937 that all defending champions have successfully retained their titles, according to the ATA.

● Thompson Products is developing a fuel system for locomotive gas turbines designed to handle Bunker "C" fuel, according to Armour Research Foundation of Illinois Institute of Technology.

● GM recently announced it plans to establish 35 training centers throughout the country for the purpose of training mechanics with GM car and truck dealerships. The first training center was recently opened in Detroit.

● According to the Petroleum Administration for Defense, there were an estimated 163,000 mi of petroleum pipe lines in operation as of Jan. 1, 1953. An additional 10,000 mi are expected to be put into operation this year.

● During the first nine months of 1953, Class I railroads installed 1683 new locomotive units in service. Of the total number put in service 1667 were diesel-electric, 12 steam and 4 gas-turbine-electric.

● Nine "Train Master" locomotives representing a total cost in the neighborhood of $2,132,000 will shortly be put into service on the Reading. The first of these 2400-hp units was displayed recently at the Reading terminal in Philadelphia, Pa.

● Recent reports have it that the Ford Motor Co. of England is shipping diesel-powered farm tractors to Detroit for distribution in this country.

● December 13 to 16, 1953 are the dates for the annual meeting of the American Institute of Chemical Engineers, which will be held at the Jefferson Hotel in St. Louis, Mo.

● Tests have been conducted by the Pittsburgh Consolidation Coal Co. on the shipping of coal by pipeline, according to the ASCE.

● Mack has recently completed the first of 16 Model LRSW 20-cu yd dumpers which are to be delivered to the United States Steel's Orinoco Mining Co. in Venezuela. Power for the 35-ton truck is supplied by a 300-hp Cummins engine.

● The annual meeting of the American Road Builders' Association will be held at Chalfonte-Haddon Hall in Atlantic City, N. J., from January 10 to 13, 1954.

● The FPC recently issued a 50-yr license to Southern California Edison Co. of Los Angeles for construction and operation of a hydro-electric project on Mono Creek in Fresno County, Cal.—another job for diesel-powered construction machinery.

● Engineers of the U. S. Bureau of Mines have put into operation a retort for producing petroleum from oil shale. Armour Research Foundation reports that results of the first runs are encouraging.

● By the end of 1953, the Canadian National Railways will have received the balance of an order for 50 diesel-electric locomotive units. Eighteen 1600-hp road switchers will come from the Montreal Locomotive Works, 24 1500-hp units are being produced by GM Diesel Ltd., and eight 1200-hp units have already been delivered by the Canadian Locomotive Co.

● The American Institute of Electrical Engineers will hold its Winter General Meeting at the Hotel Statler in New York City. The date—January 18 to 22, 1954.

● An individual on the West coast has reportedly broken the diesel speed record in a recent drag race. Rumor has it that the car was powered by a GM engine.

● According to Mr. H. Ward Zimmer, president of Sylvania Electric Products, Inc., general business activity will remain at a high level for a long time to come and only minor readjustments are in sight.

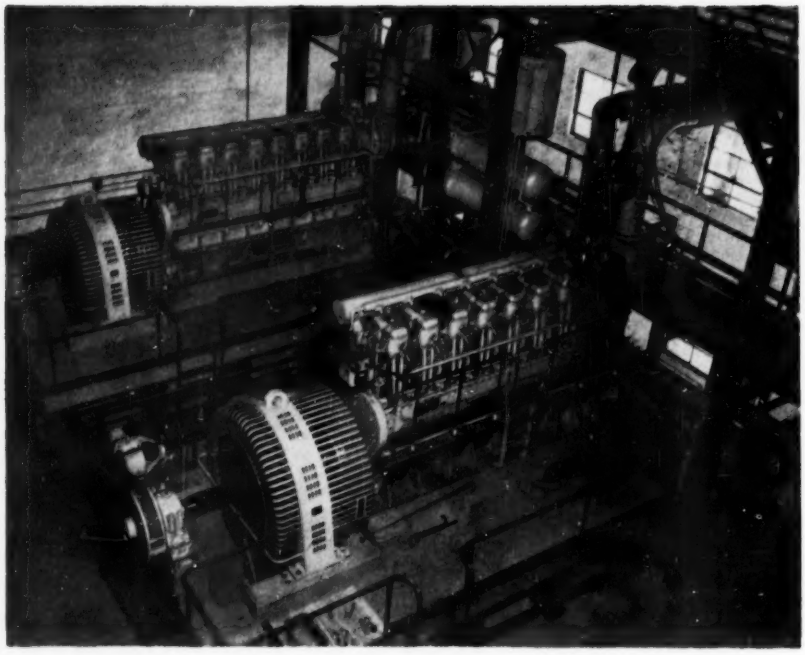
● It was recently announced by the Norfolk and Southern Railway that orders for additional diesel-electric locomotives, which will cost something in the neighborhood of $465,000, have been placed with the Baldwin-Lima-Hamilton Corp.

● The National Association of Corrosion Engineers will hold its western region meeting in Los Angeles, Cal., on the 19th and 20th of November, 1953.

● When diesel-electric locomotive units presently on order are delivered, the Pennsylvania Railroad will have a total of 1984 diesel units in its fleet. This figure represents 2,722,670 hp or an investment of approximately $300 million.

● The Sheraton-Cadillac and Statler Hotels in Detroit, Mich., will be the scenes of SAE's annual meeting and engineering display from January 11 to 15, 1954.

● The Cities Service Gas Co. of Oklahoma City, Okla., recently received authorization from the FPC to construct additional pipeline facilities. The extension of the system calls for the installation of an 1100-hp compressor unit to be installed at the company's Edmond station.



By William J. Fritton

Vice President and Sales Manager, Van der Horst Corporation of America

Paul Smith's two 1000-kw Baldwin diesel-electric generating units are an above-floor installation. A third foundation was provided for expansion.

Diesels Supplement Hydro Power

Strategic employment of diesel-electric generating units has enabled Paul Smith's Electric Light and Power and Railroad Company to renovate its existing system.

IN the very heart of the Adirondacks, hydro-electric generation has fallen short of local demands. Diesel-electric units now take over about 30 per cent of the base load for appreciable periods.

Benefiting are such famous recreational centers as Saranac Lake, Saranac Inn, Paul Smith's, Rainbow Lake, Loon Lake, Tupper Lake, and Lake Placid. In this plenteously watered mountain area the hydro-electric potential appears ample. But its development is limited by the same factors which combine to boost the power requirement.

This was disclosed by a survey in which the present situation was forecast. It showed that along the streams and lakes in Paul Smith's section of the Adirondack State Park, more and more people would build summer homes and equip them with modern electrical appliances. Yet these same people would brook no interference with water levels, particularly during the long dry summers when they come in greatest numbers to fish, swim, boat, and enjoy the scenery.

How far restrictions would apply is represented in one instance by a limit on Paul Smith's use of water to plus or minus 12 inches in the level of a comparatively small storage area. Operating practically on off-run, the utility must still meet increasing demands with firm power.

A further complication is the way daily peaks are accentuated by the unpredictable activities of vacationers. Household routine is secondary to their outdoor pursuits which, in turn, vary with the weather.

On the other hand, the healthful benefits of the high, bracing climate have led to establishment of several large hospitals, including one operated by the Veterans Administration. Paul Smith's feels that these must be served the year around without fail, despite either the foregoing factors or the hazard of transmission breakdowns during mountain storms and heavy winter snows.

Under direction of Paul Smith's General Superintendent R. H. Finch, careful engineering consideration was given each phase of the problem. The installation, operating, and maintenance requirements of alternative power sources were evaluated in relation to the existing system and the rate structure set for it by the utilities commission.

Diesel advantages came quickly to the fore. They could

be fitted integrally into the existing setup to give it the needed flexibility and added capacity at relatively low cost.

By careful planning, an outstanding economy of investment was developed in terms of the resulting service improvement. Toward this end and to keep the power cost down, each item of equipment was carefully selected. For instance, with the idea of obtaining higher availability, better operating efficiency, and reduced cylinder wear, Paul Smith's expressed preference for engines that are factory-equipped with Van der Horst Porus-Krome liners.

Installation

A similar attention to installation problems and the use of ingenuity in overcoming them permitted harnessing of the diesel source in series with existing power units to step up the system-wide distribution economy.

Diesels are independent of restrictions that limit the choice of location for other sources of power. Most of Paul Smith's hydro-electric output is developed on the Saranac River. To reduce line loss and to be able to pick up the swing and have power available from both ends of the main transmission circuit in case of emergency, it was desirable to locate the new source at the other extreme, along the Racquette River near Piercefield.

Building materials being scarce at the time, an existing structure adjacent to one of the company dams was selected. Weight of the diesel generators made considerable steel reinforcement necessary between the basement and main floor. The latter being at approximately the normal level of the river, it was decided to mount the units on above-floor foundations to avoid possible damage should the sump pump fail during flood season.

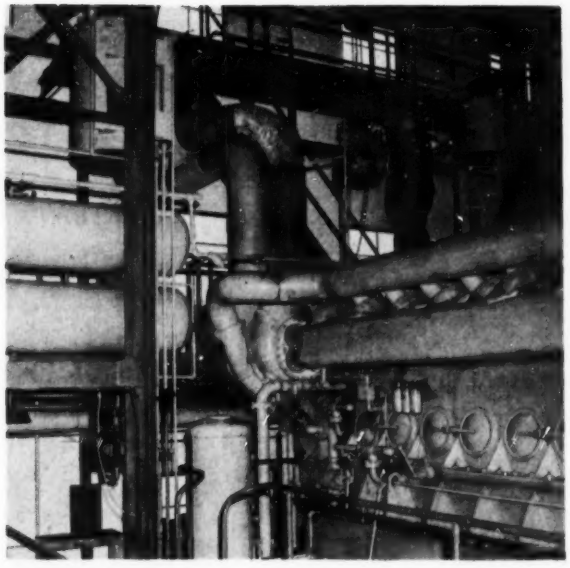
Further study revealed that the building rested on the same rock structure as the dam. The shock and vibration problem this indicated was solved by supporting each unit and its concrete foundation on Korfund vibro-isolators. In turn, considerable extra form work and reinforcement in construction of the spring-mounted engine beds seemed entailed.

General Superintendent Finch innovated the use of a welded framework of angle iron. All concrete reinforcing rods were welded to this framework and simplified forms were tied to it. This adequately retained the aggregate during pouring and agitating. The final result was both pleasing and, obviously, of higher utility since the angle iron protects all corners and edges.

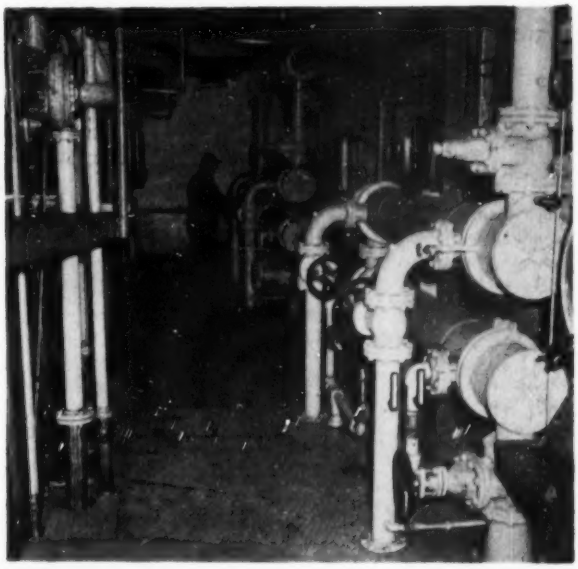
Engines and Auxiliaries

Three separate diesel generator positions were provided, with one being left for future development. Two Baldwin 600's with Westinghouse 1000-kw generators were installed.

The eight 12¾-in supercharged cylinders in each Baldwin have Van der Horst chrome as standard protection. Of 15½-in stroke and rated at 1450 bhp at 600 rpm, the engines have been run at 90 per cent of their capacity for continuous periods as long as 62 days. At the end of 4736 hours of service, a liner was pulled for inspection. Wear



Starting air equipment is accessible from the catwalks. At the time of this picture, a head was pulled so liner wear might be checked.



Heat exchangers for jacket water and lube oil are conveniently arranged behind each of the engines. Note extensive use of flexible lines.

on the "Porus-Krome" was found to be 0.0015 of an inch.

The 1000-kw, 2300-v at 80 per cent power factor generators are direct-connected. Westinghouse exciters, rated at 15 kw and 125 v at 1750 rpm, are shunt-wound and V-belt driven from an extension of the generator shaft.

Flexible connections are provided between these two diesel generator units and all equipment not located on the vibro-isolated beds. Engine cooling is accomplished by a conventional closed-type system in which the water passes through shell-and-tube-type heat exchangers.

Raw water from the river comes in through trash racks and is carried by a 30-in cast iron pipe to an 800-gal concrete well. From this well, the water passes through a ¼-in screen before entering 8-in foot valves and suction lines.

Diameter of the three lines comes down, through a long-radius reducing elbow, to four inches for connection with the three 400-gpm centrifugal single-stage pumps. From the latter's 3-in discharge, the flow passes through a 3-in to 6-in long radius elbow and thence to an 8-in common feeder-header.

After circulation through the engine lube oil heat exchanger and on through the jacket water heat exchanger, a common discharge header returns the water to the forebay of the hydro-electric plant. By reason of this simplified layout, a single pump was found capable of supplying both engines.

From barge-unloading terminals on either the St. Lawrence or Hudson Rivers, diesel fuel oil is brought in by motor transport. It is stored in a 50,000-gal tank which was converted from a former steam accumulator. From this, it flows by gravity and is fed through individual strainers, filters, and meters to the gear type transfer pumps which supply the 150-gal day tanks.

Out of the day tanks, the fuel flows by gravity to the engine-driven fuel supply pump. As an added precaution, a hand pump and series of globe and check valves were installed to permit bypassing in case of trouble.

In fact, all pumps are interconnected with valves so that anyone of them can be used to fill either day tank. And the day tanks are also interconnected. Oil, bypassed by the engine fuel pumps, flows to a sump tank in the basement from which it can be pumped back to the fuel oil tanks by the same system used to fill the day tanks.

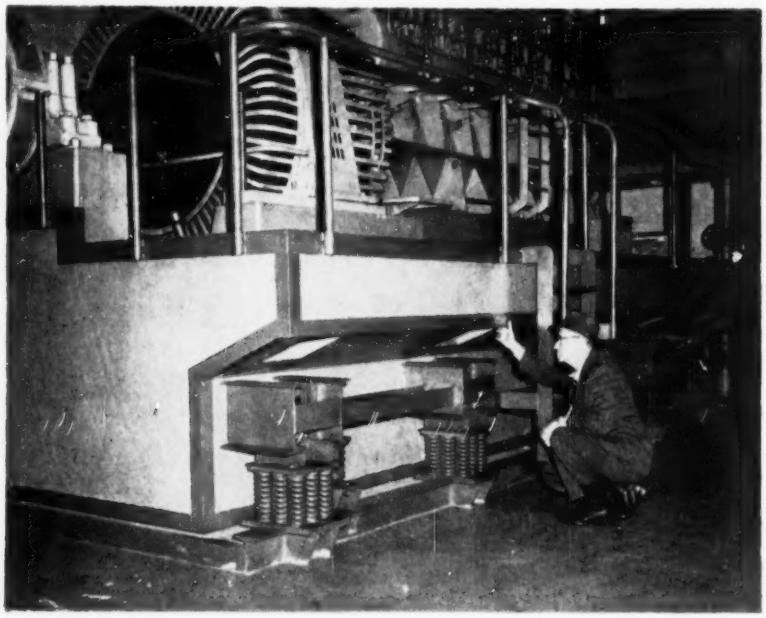
Compressed air for starting the engines is provided from two storage tanks at 250 psig. The compressor is operated either by electric motor or gasoline engine.

Some Figures

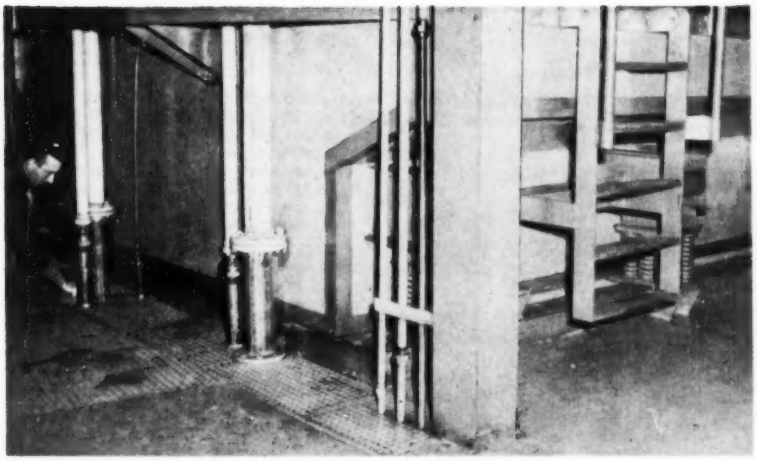
Total cost of the diesel unit was $152.40 per kw of installed capacity, according to Paul Smith's Auditor, W. T. Lins. He states that the company's hydro-electric installations cost $138.57 per kw of capacity. But the hydro units were completed for the most part during the first decade of the present century. None have been built since the depression year of 1931. The definitely higher costs of the early post-World War II period are reflected in the price of the diesel unit.

In 1952 the company produced 21,947,290 kw hr of hydro-electric power at 5.65 mills per kw hr before taxes. Diesel-electric generation totaled 2,652,700 kw hr at 1.81 cents. This dropped to 1.24 cents, or about twice that for hydro power, when the diesel load factor reached 90 per cent.

These kw hr figures include depreciation of the post war diesel unit on a 25-yr basis, whereas the hydro figure includes depreciation at only half that rate, being spread over 50 years.

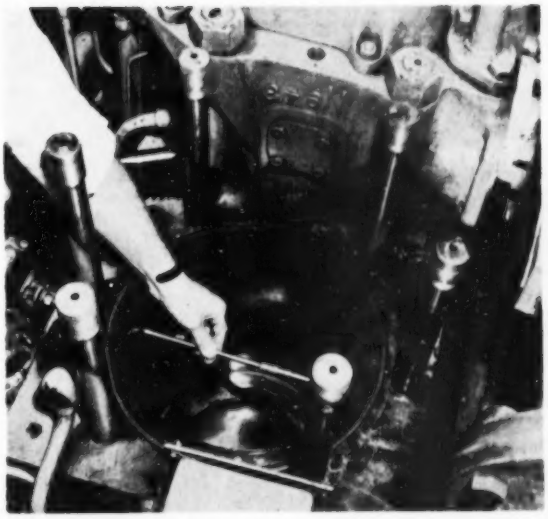


Vibro-isolators of Korfund design support the reinforced concrete beds which were specially designed by Paul Smith's General Superintendent R. H. Finch. Mr. Finch is shown inspecting the angle iron which protects all corners and edges and which is welded to the reinforcing rods.



Flexible metal hose connections complete the vibration-proof set-up so that all lines connecting the engines with equipment not mounted on the isolated beds are also freed of shock.

After 4736 hrs of on-the-line service, a cylinder head was inspected and miked for wear.



Also entering into the diesel cost is 0.91 cents per kw hr for fuel oil at the delivered price paid by Paul Smith's. Auditor Lins shows the average output per gal of fuel to be 13.31 kw. This is amplified on by Floyd DeMass, the company's chief operator at the diesel-electric plant. He says the output is 13.25 kw per gal during the time the tie line to the eastern part of the system is open for rebuilding or repairing of lines.

Throughout this period, its diesels operate at 40 per cent of capacity. Gulf No. 2, consumed in the "Porus-Krome" cylinders, develops 13.75 kw per gal when operation is at 90 per cent load. At such times, lube oil consumption is about 5 gal of Gulf HD 40 per 24 hr for both engines, he adds.

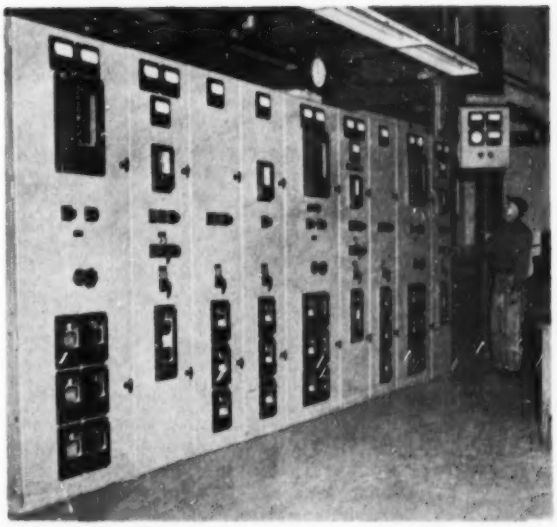
Easily overlooked in such comparisons of cost per kw hr is the system-wide dependability and efficiency contributed by the diesel installation. Unequalled in standby value, this source is able to take over 30 per cent of the base load in two minutes from a cold start.

Summary

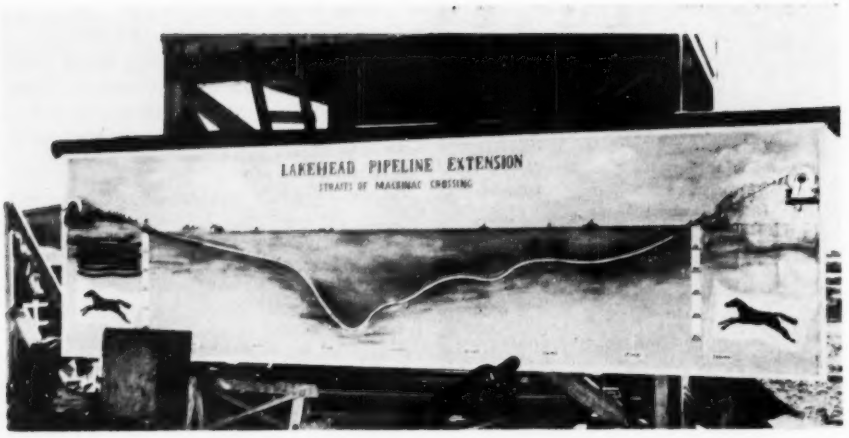
As advantageously located by Paul Smith's, the diesels assure a quick return of service in case of line break by enabling the load to be handled from both ends of the circuit.

The shortened transmission distance, which lowers line loss, become important not only when the diesels are called upon to handle base load, but during the frequent intervals when they are relied upon for peaking.

With much faster governor and switchgear reaction than is possible from hydro power, the diesels contribute their refinement to the entire system. The result, in terms of smooth, dependable handling of increased line load with firm power is a value as yet unappraised. Still, it is the basis of satisfaction among Paul Smith's growing list of customers including permanent residents and business, hospitals and vacationers.



Control panels, attended by Chief Operator Floyd De Mass, are arranged in three units to provide for additional diesel generator when needed.



Merritt-Chapman and Scott appreciated the public's interest in the crossing and erected this animated billboard diagraming the project. "Sidewalk" engineers, watching the board from a specially constructed grandstand, were kept currently posted on the pipeline's underwater-crossing progress.

The Lakehead Pipeline Goes Through

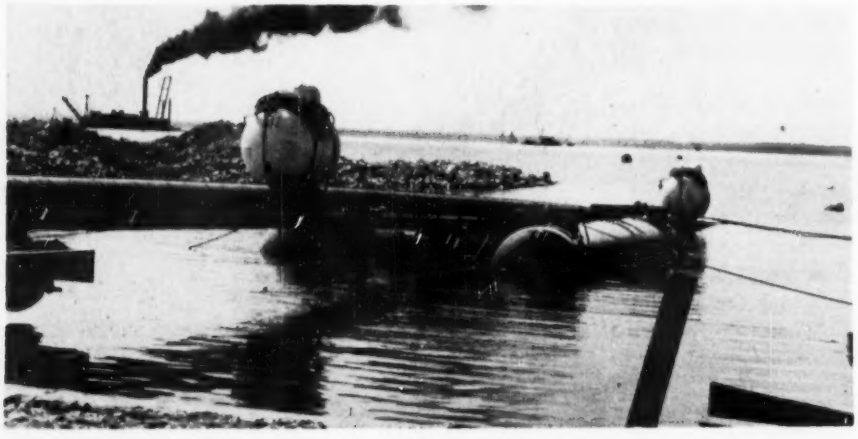
To beat the early winter deadline set on this Michigan pipeline project, an army of men and diesel-powered machines worked day and night.

MEN and machines were working day and night in northern Michigan last summer to beat the early winter deadline set for the completion of one of the longest and largest crude oil pipelines ever to be constructed.

Early in August, the 30-in pipe, which was being laid between Sarnia, Ontario and Superior, Wisconsin for the Lakehead Pipeline Company, was being inched through both the lower and upper peninsulas of Michigan to the Straits of Mackinac. There it was to divide into two 20-in sections to make one of the longest, deepest, and most spectacular water crossings ever recorded in pipeline history.

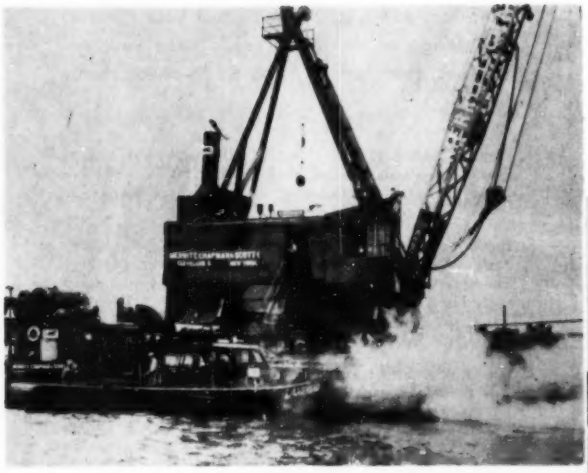
Moving across the Straits of Mackinac at the same time were three barges engaged in towing a 4-mi length of 2-in cable which was to be attached to the pipe. On the south shore, a giant diesel-powered winch was waiting for the connection to be made so that the first of eight 2500-ft sections of pipe could be started out across the Straits. Crew boats, utility craft, and barge tenders were churning up the waves and loud speakers barked orders from every side.

On shore, fleets of diesel-powered welding machines, ditchers, tractors, power shovels, and other equipment were working inland a hundred miles or more. The sharp reports of dynamite charges opening up rocky terrain on the line's right-of-way resounded over the countryside. Workmen were sloshing around in upper Michigan swamplands and here and there a piece of equipment would bog down to the axles in the wet, soft terrain. But the line was going through.



A Sunday morning in August and the first section of the pipe has been started out across the Straits. Bouys ride the pipe to keep it from sinking immediately to the bottom. Parts of the pipe will submerge to a depth of 243 feet before resting on the bottom.

Here, the Lakehead helps keep the cable-laying barge on its exact course across the Straits by running guide lines to the bouys previously spotted by the engineers. Propulsion power for the Lakehead is supplied by a GM 6-cyl diesel.



Before the first underwater link of the pipeline could be moved into place, a 2-in cable had to be pulled across the Straits and connected to the waiting pipe. At this point the barge Cherokee has the 4-mi cable in tow.

Here, a tight-fitting disc, commonly called a "pig" is being shot through a section of the welded pipe to remove accumulated dirt or obstructions. Rabbits or porcupines which occasionally take refuge in the pipe get a fast ride out when the "pig" is "cannonballed" through with air from this GM diesel-powered I-R compressor.

On shore, Midwestern Constructors' workmen using diesel-powered Lincoln welding machines, weld pipe into 16 units of 2500-ft each. These make up the two 4-mi underwater sections to be used for the Straits crossing. Each weld on these pipes was being X-rayed to assure perfect connections all the way.

To take the kinks out of welded pipe sections, three diesel-powered tractors with slings attached to their drawbars were used. Other diesel-powered tractors were being used to move pipe and welding machines into position and also for other utility jobs.

Above is a section of the pipeline after it has emerged from the Straits of Mackinac and moves westward through Upper Michigan swamplands toward Superior, Michigan. Here, welders use wooden platforms to keep from sinking knee-deep into the water-soaked terrain.

As would be expected on any 635-mile trenching job, the Lakehead pipeline encountered considerable rocky terrain along its route. Where the going was rough, Midwestern used six of these diesel-powered backhoes to follow the blasters along the route.

The Straits crossing was in the hands of the Merritt-Chapman and Scott Corporation of Cleveland, Ohio, with Midwestern Constructors, Inc., of Tulsa, Oklahoma, working as sub-contractors. Midwestern also had sections of the line under construction both above and below the Straits.

The accompanying illustrations show some of the equipment being used and some of the jobs being done as the big pipe was being readied and pulled across the Straits and then pushed westward to Superior, Wisconsin. There it was to be connected with the Interprovincial pipeline of Canada and then the two lines, covering a distance totaling 1765 miles, were to comprise one of the longest and highest capacity pipelines in the world.

What Do You Know!

Here are some questions to test your general knowledge of the diesel field. Make your selections, then turn to Page 69 to check them.

1. Engines burning LPG (liquid petroleum gas) normally have compression ratios that are:
   a. Same as gasoline engines b. Same as diesels
   c. Intermediate

2. Three equivalent capacity buses each with a different type of power are listed below. How would you rate them, lowest to highest, on the basis of maintenance costs for 200,000 miles of operation?
   a. Gasoline-powered bus b. Diesel-powered bus
   c. LPG-powered bus

3. Vibration isolators are satisfactory for the smaller engines but they lose practicality with engines of, say, 1500 hp.
   a. True b. False

4. Porus-Krome liners are noted for their wear resistance. What would be your estimate of wear in a 12¾-in liner of a supercharged engine after, say, 4500 hours of operation?
   a. 0.0005 c. 0.002 e. 0.003
   b. 0.0015 d. 0.0025 f. 0.0035

5. A "pig" in pipline parlance is:
   a. A back-hoe that hogs out a pipe trench
   b. A tight-fitting device forced through a pipe to clean it.
   c. A long section of pipe with small suction pipes every few feet used to pump ditches.

6. With municipal generating installations, low part-load operation is frequently unavoidable. Dual-fuel engines burn considerably more fuel under such conditions unless —
   a. Pilot oil is reduced
   b. Volume of intake air is reduced
   c. Gas fuel pressures are reduced

7. The prime reason for crankcase explosions is localized heat from a mechanical derangement and an optimum air/vaporized lube oil ratio. The original explosion is generally—
   a. Of high intensity
   b. Of low intensity

8. Which of the following schemes is the least practical to avoid damage from crankcase explosions?
   a. Provide spring-loaded explosion relief doors
   b. Design engine to contain primary explosion pressures
   c. Completely ventilate base to insure too lean a mixture for combustion

Williamsport Technical Institute

A well planned curriculum, a good placement record, and well rounded practical as well as theoretical training is what the Williamsport, Pa., Technical Institute offers its students.

A SCHOOL is as good as its placement record. The latter is of prime importance at Williamsport, and through close cooperation with industry plus the training of a student for a specific job in industry, a high placement percentage has been obtained. Williamsport feels that a school that does not succeed in placing its graduates in worthwhile positions is only doing half the job.

Doing the whole job calls for a well-rounded curriculum, embracing both the theoretical and practical and closely following the requirements of industry. This places the graduate student in a better position to compete for a job and also aids the placement program of the school.

Two Courses in Diesel

Of the nearly 40 courses given at the Institute as part of the Williamsport public school system, two are devoted to diesel engine and equipment maintenance and operation. One course is for diesel mechanics and the other for construction equipment operator and serviceman. The length of each course is about two years, with the major part of the time being spent in the laboratory or in the field, working with the equipment.

The success of the school is indicated by the fact that many students come from other parts of Pennsylvania and in some cases other states. A large number of students are sent by the United Mine Workers, while the Pennsylvania, Ohio and West Virginia rehabilitation bureaus send physically handicapped men.

Diesel Mechanic—In this course, students are prepared for jobs as mechanics or operators on diesel and diesel-electric equipment. The course of instruction includes marine stationary and portable units.

In the laboratory, 17 engines are distributed throughout the 4500 sq ft of floor space. Engine types and sizes vary all over the lot, with ratings ranging from 5 hp to 225 hp. Both 2-cycle and 4-cycle normally aspirated or supercharged engines can be found among the units which represent many diesel engine manufacturers.

Included in the diesel mechanics course are electric theory and welding. This is in addition to the operation and repair of diesel engine systems and auxiliaries which includes power transmission, application, and measurement.

The electrical and welding work have been incorporated into the course to better equip the student for a job in industry. Another portion of the course is devoted to machine, hand tools, and bench work.

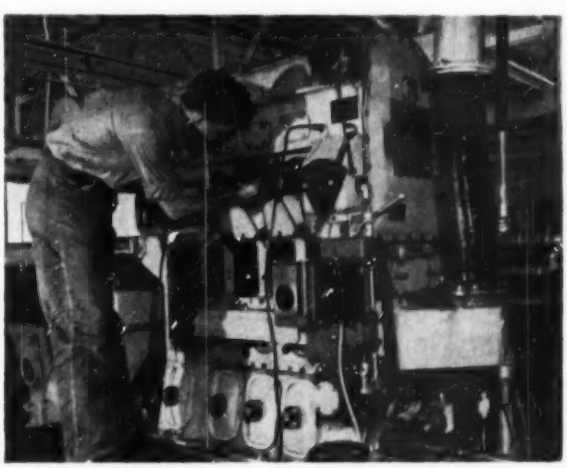
Construction Equipment Operator and Serviceman—In addition to instruction on the proper method of operating all types on modern construction and earthmoving equipment, the student taking this course is instructed in the fundamental principles of the diesel. Also included in the course are subjects such as machine, hand tools, bench work, rigging, hitches, slings, couplings, welding and related math, and surveying.

Students finishing this course have a well-rounded knowledge of earthmoving. Their practical training is in the field working with equipment such as may be found on any large construction job. Dozers, motorized patrol graders, ditching machines, scrapers, cranes, power shovel, and road roller are available for training. While training, students operate the equipment on school and community construction projects.

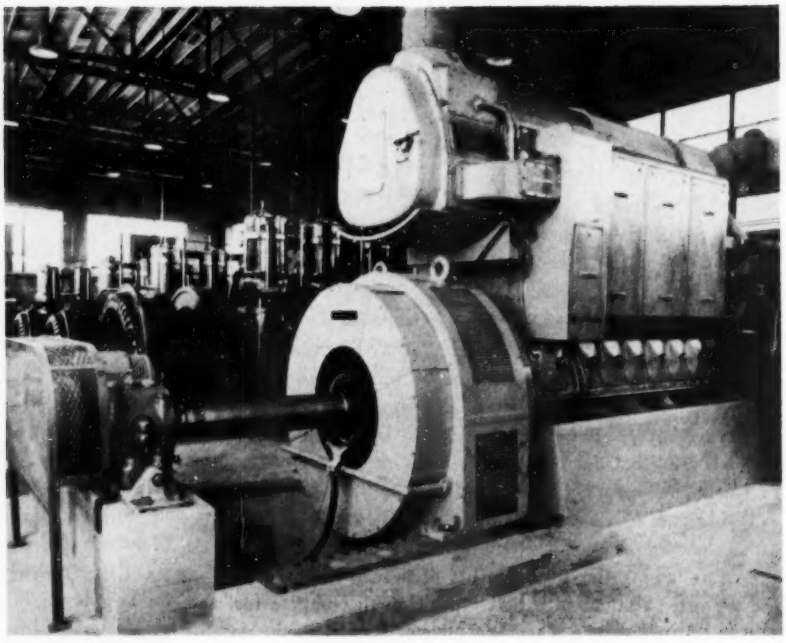
Summarizing

Williamsport believes that practical training is a prime factor in technical training. This is carried through the entire curriculum of the institute. Learn by doing might well be called the watchword of Williamsport Institute.

Operated as part of the public school system, the school affords vocational-technical training closely allied with the requirements of industry. It provides a stepping stone from high school to college or a higher degree of learning for those students not wishing a college education. As such, schools of this type help the high school student in becoming better prepared to step into industry.



Here, one of the students at Williamsport adjusts the fuel racks on a Model 38 E 5¼ Fairbanks-Morse opposed-piston engine.



Newest and most powerful engine in the Teague plant is this 960-hp, 6-cyl Fairbanks-Morse opposed-piston engine, driving a 675-kw generator.

As a step toward plant modernization, the City of Teague has installed an F-M dual-fuel opposed-piston engine and cut fuel costs per kw hr to an average of below four mills for the plant.

Teague, Texas Adds an Engine

By R. D. Slonneger

Assistant Professor of Mechanical Engineering, University of Texas

TEAGUE, Texas, a progressive central Texas city, is producing power for less than four mills per kw hr. However, before we go on, let's take a look at the community.

Teague is a residential community serving a rich farm area. Located in Freestone County in the eastern part of central Texas, Teague has within a 150-mi radius well over 50 per cent of the entire population of the State of Texas.

The city has excellent transportation facilities. It is served by the Joint Texas Division of the Chicago, Rock Island and Pacific Railroad Company and the Fort Worth & Denver Railway Company. Teague is a division point for these railroads and they maintain shops, roundhouse, and general offices there. These railroads employ 376 people and have an annual payroll of over $1,250,000. Teague is also served by two bus lines operating East, West, North, and South and in addition has major highways and a fine farm-to-market highway system. There is also a CAA approved airport. The city has four modern schools, 13 churchs, and a modern A.M.A. approved hospital.

Industrially, in addition to the railroad companies already mentioned, Teague has a face brick plant, an air conditioning manufacturing plant, a woodworking and sheet metal plant, oil pumping stations, steam laundry, and ice plant. There is also considerable gas and oil development around Teague.

The East Teague Field and the West Teague Field are proven fields for production of natural gas, as is the Freestone Field south of Teague. Drilling is underway now on more wells and the West Teague Field is expected to be tied in with major pipelines.

Start of Municipal Power

On November 18, 1952, the city of Teague placed three 180-hp F-M diesel engines into operation to inaugurate the municipally owned power service. The increase in power demand, illustrated in Table I, brought about a corresponding growth in the power generation facilities required.

In 1939, a 375-hp F-M engine was added. After 13 years of service, one of the original 180-hp engines was removed, in 1942, to make way for a 450-hp F-M engine. This was followed in 1947 by the addition of the last straight diesel engine, a 575-hp unit. This too was an F-M.

Increased fuel costs, added to the fact that the existing plant was rapidly getting full of small engines, caused the greatest change in the plant operation. August 1952 marked the placing into service of a 960-hp Model 38 DD8-1/8, 8 1/8-in by 10-in, 6-cyl, F-M opposed-piston dual-fuel en-

gine. At this same period, the physical plant was extensively remodeled and a new electrical switchboard was installed.

An interesting sidelight in the story of this plant is a piece of auxiliary equipment placed in service on November 18, 1929. An F-M centrifugal water pump was installed in the raw water circuit, and at the time of installation, some good natured byplay caused a manufacturer's representative to promise free replacement of the pump in 20 years providing the seal was not broken.

Record was made of the promise, and in 1949 Fairbanks-Morse offered to replace the pump. However, the plant superintendent, Mr. B. H. Tyus, did not choose to part with an old faithful servant. Today, after practically continuous operation for 24 years, the pump (with unbroken seal) is still serving as a raw water pump.

Load Growth

The low operating cost of four mills per kw hr is especially important, considering the ever-increasing load on the Teague plant. The continuous increase in demand is shown in the following table:

Table I Load Growth

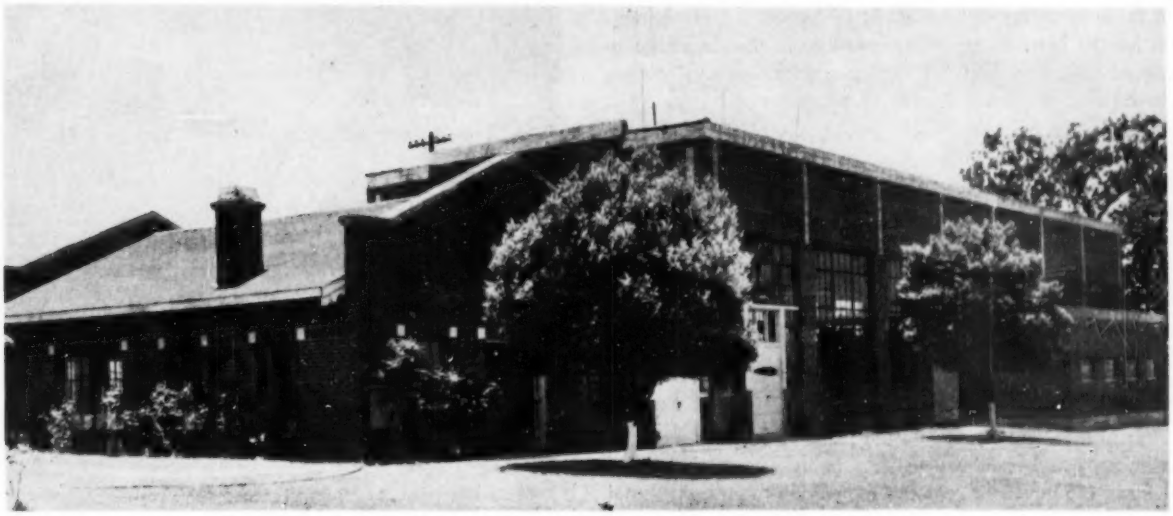
Year	Total Kw Hr
1930	932,100
1935	1,019,100
1940	1,224,400
1945	1,809,500
1950	2,576,400
1952	3,049,900

During this same period, the water pumped by the municipal water works increased from 58 million to 81 million gal per year, while water reserves have been built up to 700 million gal. With less than a 100 per cent increase in the water consumption, the 300 per cent increase in electrical demand is due largely to the increased per capita use of electricity by the citizens of the community. This consumption has been encouraged by low rate schedules.

Plant Figures

Reliable service, free from maintenance troubles, is important for both prime movers and accessory equipment, but low operating cost is equally important to Mr. J. E. Lambert, manager of utilities for the city of Teague, as well as for the taxpayers and power customers. Striking changes were wrought in this field when the switch was made from diesel to dual-fuel operation.

Table II is illustrative of the period from June 1952 through May 1953, clearly demonstrating the savings realized with the introduction of an efficient dual-fuel engine utilizing natural gas as the principal fuel. The cost of power generation during June and July 1952 was about



An exterior view of the Teague municipal power plant suggests all-around good maintenance.

8 mills per kw hr fuel cost for operation with straight diesel engines. August 3, 1952 marked the beginning of service with the Fairbanks-Morse opposed-piston dual-fuel engine, resulting in the sudden reduction in fuel costs to 3.6 mills per kw hr.

Plant growth is such that the new engine can be operated practically all of the time without assistance from other equipment, but it must be emphasized that the figures in the table are for the entire plant, not just for the new engine. Since installation, the heavy-duty engine has been on the line nearly 95 per cent of the time.

A study has been made of the lubricating oil costs for the plant before and after the installation of the new unit. Figuring on the basis of 50 and 60 cents per gal, June and July 1952 showed 0.72 and 0.75 mills per kw hr for lube

oil costs. This was prior to operation of the O-P engine.

August through November break-in period for the new engine, averaged about 0.60 mills per kw hr and the final settling of the piston rings reduced the cost to 0.37 and 0.36 mills per kw hr in December 1952 and January 1953, respectively. Expressing the figures for the last two months in a different manner, December shows 4578 hp hr per gal of oil and January indicates 4994 hp hr per gal.

During the period covered since the installation of the O-P engine, it was the only engine on the line most of the time, so the figures are for all practical purposes for that engine alone.

Inspection of the cylinders was made at frequent intervals by looking through the ports. These checks, bi-weekly at first, revealed no ring sticking and an extremely small amount of carbon deposits, indicating almost perfect combustion with attendant long life for piston rings and cylinder liners.

Mr. Tyus believes that the unusually small quantities of carbon deposits, even though the engine operates much of the time at part load conditions (often as low as 150 kw), is due to the air bypass control provided on the discharge of the scavenging air blower. At low loads, the air delivered by the blower can be bypassed from the discharge to the suction, thus maintaining good combustion efficiency throughout the usual operating range.

As the engine load drops, the operators watch the exhaust pyrometers and reduce the air flow to the engine until uniform exhaust temperatures are indicated from each cylinder. Such operating technique assures balanced loading of all of the engine cylinders.

The engine operates at 720 rpm and is direct-connected to a 675-kw Fairbanks-Morse generator with a belt-driven exciter. An engine control and alarm panel is located near the blower end of the engine.

General Description

Natural gas is supplied to the plant at 26 psig, where it is metered and regulated to 25 psig. In case of failure of the gas, the governor switches the engine to straight diesel operation.

Starting the engine is accomplished with compressed air from 6 tanks containing air at 250 psig. Two motor-driven, and one gasoline engine-driven, compressors provide the compressed air.

Pilot oil is of a fairly high grade, zero distillant type, in order to minimize storage problems at low temperatures. When the plant operated on diesel fuel alone, it was a policy to use a higher grade of fuel in the winter, and a cheaper fuel in the summer when storage problems were not so great.

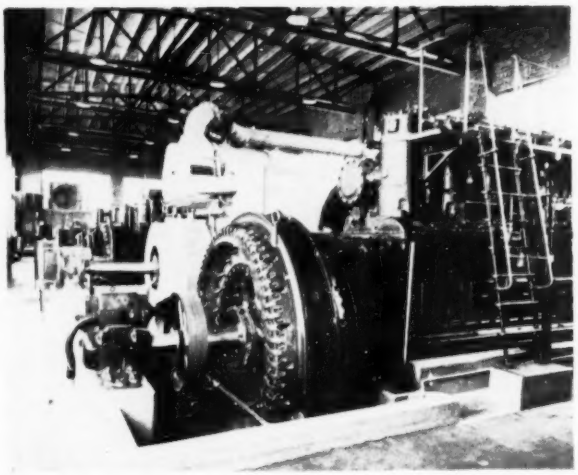
Two above-ground tanks, with a 10,000-gal capacity, supply a 625-gal day tank by gravity flow. Metering is accomplished between the storage tanks and the day tank. Fuel oil is delivered from the day tank by an engine-driven gear-type fuel pump through a 2-cartridge filter to the injection pumpheader, the overflow returning to the day tank.

A "Cycloil" type oil-bath intake air filter and silencer

Table II City of Teague, Light Plant from June 1952 to May 1953

Month	Total Kw Hr	Lube Oil Gallons	Fuel Oil Gallons	Gas M Cu Ft	Fuel Cost Dollars	Mills/ Kw Hr
June	275,300	402	24,640		$2233.80	8.1
July	312,100	473	26,920		2449.15	7.8
Aug.	348,500	346	4,782	3,998	1280.77	3.6
Sept.	285,600	272	3,558	3,506	1052.75	3.6
Oct.	237,500	263	6,525	2,507	1122.40	4.7
Nov.	227,900	245	5,970	2,389	1045.65	4.5
Dec.	249,600	156	3,525	3,253	937.42	3.7
Jan.	240,200	143	3,520	3,213	931.21	3.8
Feb.	214,400	134	3,065	2,969	833.51	3.9
Mar.	241,200	130	3,360	3,331	918.87	3.8*
Apr.	200,600	150	4,910	3,011	902.70	4.5
May	246,000	135	3,455	3,443	959.40	3.9

*New Fairbanks-Morse engine only unit in service for this month.



Housed in the plant are six F-M engines ranging in size from 180 hp to 960 hp. The new dual-fuel OP engine is second from the right.

Equipment for Latest Engine

Engine	Fairbanks, Morse & Co.
Exciter	Fairbanks, Morse & Co.
Fuel System	
Oil pump	Fairbanks, Morse & Co.
Oil filter	William W. Nugent & Co.
Gas	Lone Star Gas Co.
Lube Oil System	
Oil	Magnolia Petroleum Co.
Pumps	Geo. D. Roper Co.
Filters	Fairbanks, Morse & Co.
Heat exchangers (water and oil)	Kewanee-Ross Corp.
Exhaust silencer	Maxim Silencer Co.
Intake air filter	American Air Filter Co.
Water pump	Fairbanks, Morse & Co.
Exhaust pyrometer	Illinois Testing Laboratories Inc.
Gauges	Fairbanks, Morse & Co.
All motors for pump drives	Fairbanks, Morse & Co.
Switchboard	General Electric Co.

is used on the suction of the gear-driven Roots-type blower for scavenging air. Air is discharged from the blower at about 2½ psig, passing through the manually operated control valve before reaching the supply manifold to the cylinders. Exhaust products pass from the plant through a silencer, which, incidentally, is still very clean after nearly one year of service.

A heavy-duty detergent-type oil has been selected as the lubricating oil for service with this engine. The wet sump has a 240-gal capacity for lubricating oil and at present the operators add just about 4½ gal each day. A cartridge-type filter of the bypass type is operated in the system in conjunction with a strainer. The engine-driven pump and the before-operation pump are both gear-type pumps, the latter being driven by an electric motor.

The before-operation pump is used only to bring the lube oil pressure up before starting as the O-P engine does not require after-operation service. A change of oil filter elements was made after 6000 hours of operation, and it is planned to change elements at least once each year depending on the condition of the oil. This long filter life is another indication of the clean operation of the dual-fuel O-P.

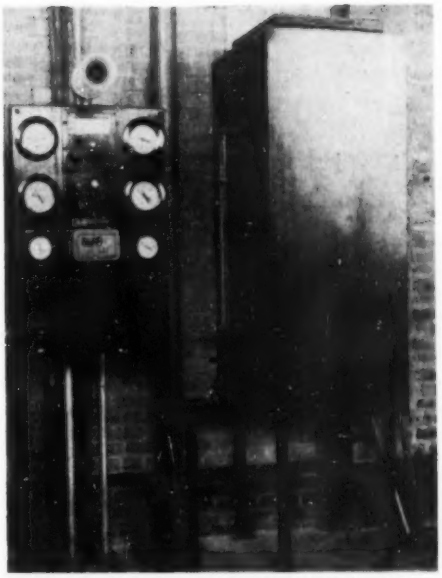
Engine jacket water cooling and oil cooling are accomplished with a closed cooling system. The raw water, which is of high purity, is circulated through the oil cooler and then through the jacket water exchanger by the aforementioned F-M centrifugal pump. Shell-and-tube-type heat exchangers are used in both cases, while the cooling tower is of redwood construction. The engine jacket water temperature is thermostatically controlled and water leaves the engine at 150°F. Ordinarily the temperature rise in the jacket through the engine is 5°F to 10°F.

Modernization of the electrical panel, control, and feeder, was instituted with the installation of the 960-hp prime mover. The old system had the board away from the generator end of the units. However, a small masonry addition to the front of the plant provided space for the new panel which is located more conveniently at the generator end of the units. Circuit changes on the board can be made more readily due to basement space under the board.

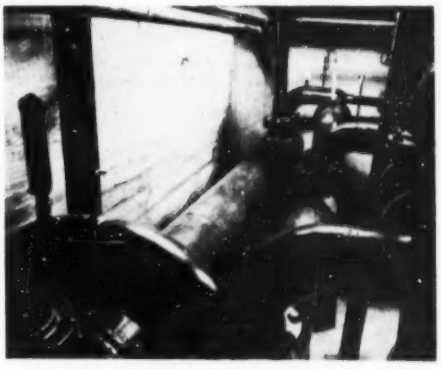
Four feeder panels (two business and two residential), one plant panel, and two extra panels for feeders were installed on the new board. Power is generated and transmitted at 2500 v. The six panels were wired out of the plant to a pole where the tie to the feeders is made. Should trouble develop in any of the feeder panels, a short jumper could transfer the load served by that panel to one of the spare panels on the board. Just a little added insurance is thus available while the plant is prepared for further expansion.

Summary

The use of low-cost natural gas in a modern efficient engine, operating in a well-run plant, is producing power at a fuel cost of half pre-gas service. Selection of the proper sized engine, coupled with the flexibility of this unit, enables the plant to economically carry loads from 150 kw to 675 kw with the cheaper fuel.

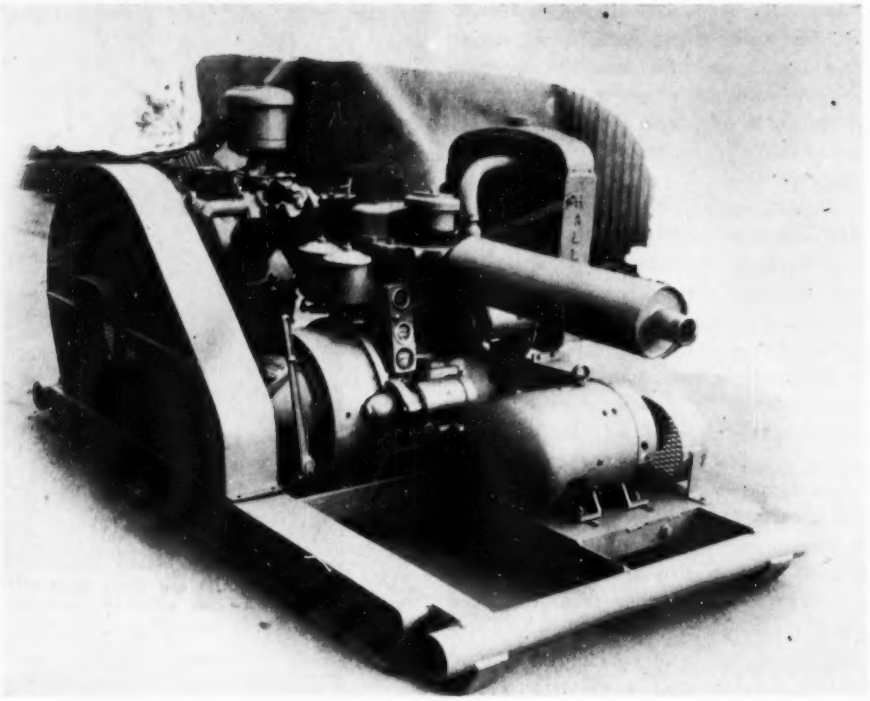


A compact gauge and alarm panel board which includes an exhaust pyrometer serves the new unit.



Jacket water and lube oil for the opposed-piston engine are cooled in shell-and-tube type heat exchangers located adjacent to the engine.

Behind the plant, at center, are the exhaust silencer and "Cycloil" intake air filter which serve the plant's newest engine.



Above, a skid-mounted Hallet Model D2B powering an air compressor and generator. This unit supplies power for lighting an oil well rig and also for air brakes and pneumatic tools.

Small Diesels At Work

Small diesels face stiff cost competition from their gasoline counterparts. Yet more and more are being used. Why? What are the factors that make them economically attractive? Here are some of the considerations influencing their choice.

WHAT'S the "condition of servitude"? That is the big question to be answered in selecting the best type of prime mover. For intermittent, light-duty applications, you can get away with just about any type of engine, but where continued hard service and long range dependability are requirements, you need premium quality. That's why you see small diesels in any number of exacting applications. And it is in just such applications that the inherent economy of the diesel shows the best advantage.

Small diesels come high in comparison to the flood of gasoline engines of similar horsepower. However, price alone is only one factor; to get a true picture there are other factors to be equated. These can be divided broadly under the headings of "performance" and "economics".

In order to get away from generalities and down to specifics, let's relate this discussion to the engines built by one manufacturer—Hallett. Their line of engines includes both air-and-water-cooled models in single and 2-cyl executions, and therefore is well suited to cover a wide range of applications.

We have mentioned the need for premium quality in a prime mover and this is bound to have an effect under our heading of "performance". So let's run through some of the construction features of these diesels in order to establish premium quality of diesels in general, and these engines in particular, when related to competitive forms of power.

Engine Details

Before getting into the construction, let's give some of the "vital statistics" of the Hallett engines. They build

four basic models, all of the 4-cycle type. Other details can best be shown in tabular form.

	Cyl	Cont. Bhp	Rpm	Bore	Stroke	Comp. Ratio	Cooling
D1A	1	8	1500	3⅞	4¼	20:1	water
D2	2	18	1500	3⅞	4¼	20:1	water
AC1	1	5.5	1800	3½	3⅜	20:1	air
AC2*	2	13	1800	3½	3¾	20:1	air

*Vee-type

These basic units provide a wide flexibility of application within their horsepower ranges since standard attachments can be added to fit the particular usage. For example, although the engines are small enough for manual starting, an electrical starting motor and battery-charging generator can be applied. Also, the water-cooled models can be fitted for tank, heat exchanger, or radiator cooling. At the output end, a power take-off clutch can be fitted or the unit can be obtained with matched generator or a pump to suit the types of service desired.

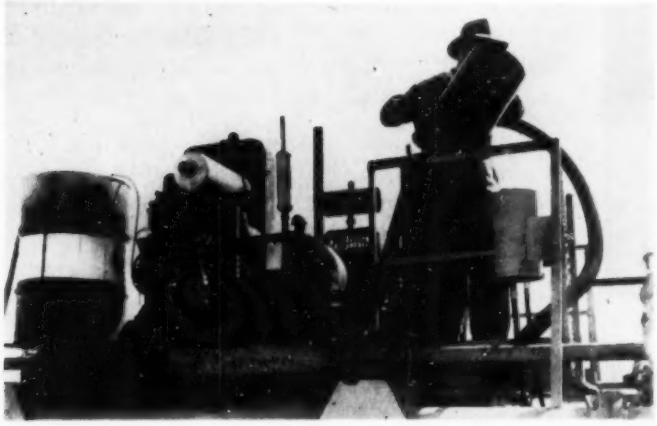
In view of the high pressures encountered in diesel engines, they are customarily built more ruggedly than their gasoline counterparts. This fact, with the generous safety factors allowed, tends to produce long service life characteristics. Then, being intended as a premium product, the designer can add the little refinements that mean so much.

If you were to take one of these diesels and a comparable gasoline engine and strip both of them down, this would immediately become apparent. We're not criticizing; you pay more but you get more. Take Hallett's crankshaft. It's a stiff, heat-treated molybdenum steel drop-forging, fully counterweighted and accurately ground. It is supported in two Timken taper roller bearings provided with adjustments to compensate for wear.

The crankcases are of rigid box-type construction cast iron for water-cooled models and aluminum alloy for air-cooled units, designed to provide the distortion-free support required of this backbone of the engine. The precision-ground camshaft, a molybdenum iron casting, is driven by wide-faced, shave-cut gearing.

Similarly, you could point to the use of precision bearings in the connecting rod big-end bore. A tri-metal bearing with steel back, a copper-lead lining, and a tin overplating is used. High temperature-resistant silchrome steel valves with extra heavy stems are used. They incorporate the refinement of a safety ring to prevent the valve from dropping into the cylinder, with the resulting damage, in the event of a broken spring.

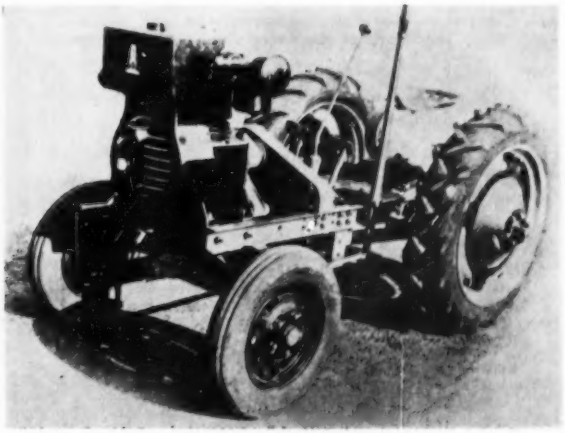
These are a few of the features, selected pretty much at random simply to make a point. We could have gone on about the positive lubrication to all moving parts, the



Power for the operation of two 3-ton hoists is supplied by this 18-hp diesel which drives a 10-kw generator. (left)

An air-cooled 5.5-hp diesel supplies power for this materials handling truck, being used in the mining and construction fields. (lower left)

To provide power for a compact, lightweight tractor (shown below) an air-cooled, single-cylinder engine is used.



carefully worked out cooling systems to insure temperature control even under the most severe operating conditions, the full-flow lubricating oil filter, and other features.

These are some of the things that influence performance of an engine in service. Its ability to sustain full-rated loads for long periods of time is as good as the service life of the weakest component. Failure of a single minor part results in down-time.

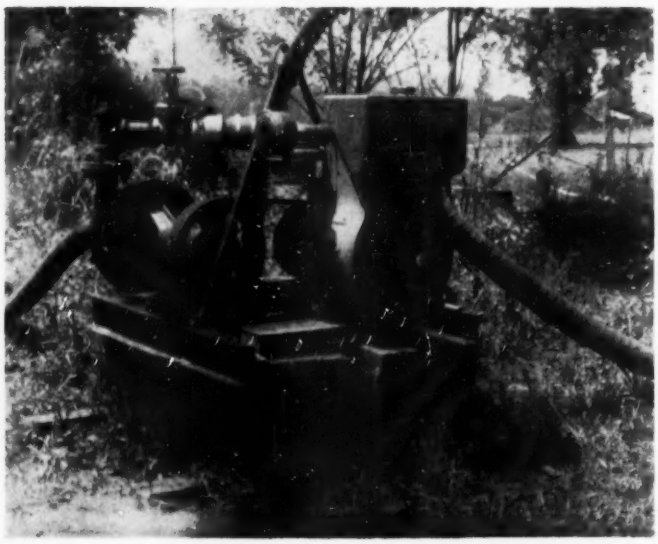
Performance

There are many applications wherein the required standards of performance easily justify the expense of a premium product. Even though the power requirement is small, the engine may power a key machine, which if out of service ties up other equipment. The cost of down-time is thus greatly magnified and places a premium on dependability.

The "Scoot-Crete" and the hoist application illustrated could well be examples of this. A classic example might be where an engine is installed as a standby to "hold" a cold storage space in the event of normal power failure.

Above, a trailer-mounted 8-hp, single-cylinder unit, equipped with 12-v starting system, being used for irrigation.

Also in irrigation service is this air-cooled unit at right, which supplies water to crop sprinkling system.



It is the last line of defense and although used seldom, it is imperative that when it functions it does so without interruption.

Dependability can be important in cases such as the pumping application shown. This is a case of unattended operation where time and expense are involved in any failure of the unit. The importance of uninterrupted operation is magnified in other unattended applications, particularly where the station is remote, and this applies where the unit is either the prime source of power or a standby.

Another phase of diesel performance is exemplified in farm tractors. Tests which are a matter of public record show that the diesel-powered tractors outwork their gasoline counterparts. There are many other cases where the high torque characteristics of diesels can be used to excellent advantage. One example is the Ruth mine locomotive where an air-cooled diesel provides the motive power.

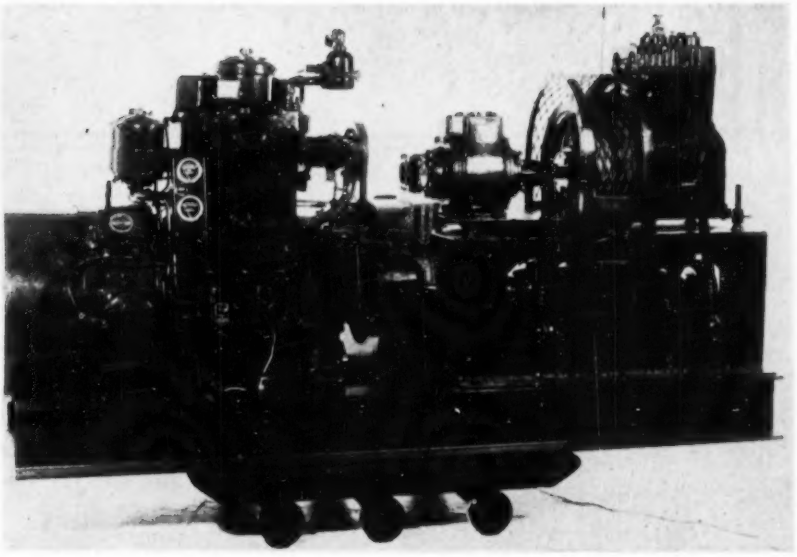
This leads to discussion of an operational advantage that might be classed under this heading. The small amount of toxic gases in the diesel exhaust makes them particularly suited for use in confined areas. Also, diesels can safely work in areas where explosion is a hazard. There is no need for electrical equipment that might create sparks, and a simple exhaust washer will eliminate the danger from that source.

Reduction in fire hazard, alone, can be justification for choice of a diesel. The relatively high flash point of diesel fuels can greatly affect fire insurance costs. But this is really a matter of economics.

Economics

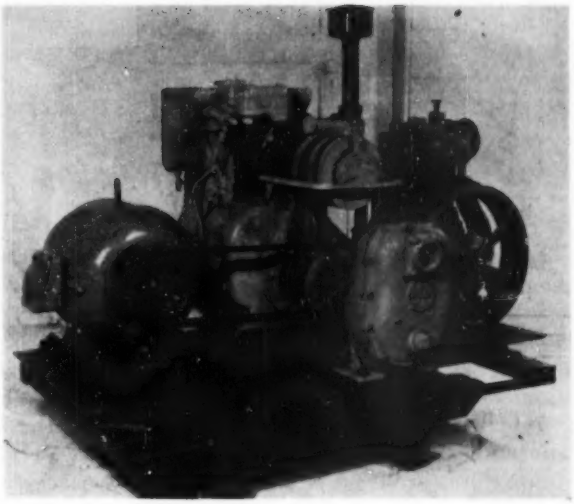
We have a premium product at a premium price. The question is, "Can the additional investment be justified?" There is no categorical "yes" or "no" answer.

On one hand is the premium cost dictated by the num-



At left, a marine auxiliary unit which powers a generator, compressor and pump. The engine is an 18-hp unit.

Below, another marine auxiliary also powering a generator, compressor and pump. This engine is an air-cooled unit.



ber of units built, the quality construction features, and the cost of precision injection equipment that is much greater than the cost of the carburetor and ignition system on a gasoline engine. Now, what can be put on the other side of the scale to balance this?

First, is the matter of fuel cost. There will be some saving on a gallon for gallon basis. These particular little engines are not prima donnas when it comes to fuel. In reference to the Model AC1, the lowest horsepower unit, Hallett says, "Any clean grade of distilled diesel fuel oil, 28 to 45 API gravity, cetane No. 36 or better (commercial fuels such as standard diesel, heavy diesel, common kerosene, Chevro-Jet, and JP-4 jet engine fuel) may be used satisfactorily". You can pick the cheapest fuel available locally.

The diesels will burn less fuel. The smaller units average about 0.47 lb per bhp at full-rated load and speed, and the larger ones, 0.43 under the same conditions. So there will be a savings in both the cost of fuel and the fuel used. In view of the small total quantity of fuel used, the significance of this saving will largely depend upon the degree of utilization. The diesel, however, is built for long, continued service, so where this is anticipated, the fuel savings possible make the diesel a logical choice.

The premium construction will provide long, trouble-free service. This will show up in maintenance costs. In the smaller engines it is not so much a matter of parts cost, but the labor involved. It is hard to put a dollar value on dependability, but in key positions as mentioned, down-time costs can be a very sizable item, often far outweighing the difference in the original cost of the equipment.

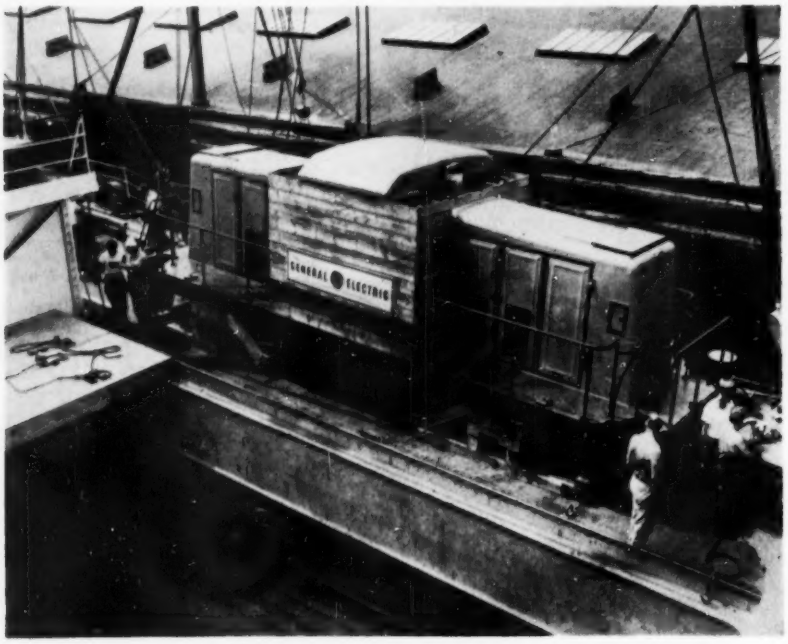
There are frequently many incidentals to be figured that will tip the scales in favor of the diesel. We have mentioned the fire hazard angle and its effect on insurance. Where small diesels are used in conjunction with larger units as in the oil fields or on shipboard, for example, the handling and use of a single fuel can be more economical.

When all the factors are figured, you will find that the investment is self-amortizing. Thus, you can have the advantages of diesel power at no extra cost. The period of amortization will vary with utilization, and soon the hard-working unit will be paying dividends.

Conclusion

You generally get what you pay for and very often there is nothing more expensive in the long run than something cheap. Don't just figure original costs; take all of the factors into account. If your power needs are anything more than casual, you need heavy-duty equipment. That's why more and more small diesels are being put to more and more uses every day.

DIESEL BRIEFS



GM Diesel Locomotives to Mozambique

Copper and gold mining companies throughout the world are turning more and more to diesel-electric switching locomotives for fast, economical service, and ease of operation and maintenance.

Recently, two 65-ton diesel-electric locomotives left New York, bound for the port of Beria in Mozambique, Portuguese East Africa. From there, they will be shipped 1600 miles by rail to Nkana, the site of copper mines owned by the Rhokana Corporation, Ltd., a subsidiary of the Anglo-American Corporation, Johannesburg. The locomotives will be used to haul ore in the mines. Four of the 65-ton units will shortly be in service in Northern Rhodesia.

Built in GE's Erie, Pa., works, each 65-ton unit is powered by two Cummins supercharged diesels having a total rating of 550 hp. These four locomotives are similar to six units already in service in Southern Africa for other subsidiaries of the Anglo-American Co.

37 Diesels For Great Northern

Expenditures of $6,100,000 for 37 new diesel-electric locomotive units and $14,726,000 for track and bridge improvements in 1954 was authorized by the Great Northern Railway board of directors.

The locomotive units will be of 1500-hp each. Six units will be for use in road locomotives and 31 will be used for both switching and road duty operations. The track and bridge program includes purchase and placing of 37,000 tons of 115-lb rail on various sections of the railway.

New Caterpillar Parts Depot

A new parts depot for the Caterpillar Tractor Co. will be located in Denver, Col., to improve service for approximately 14 company dealers in the Northwest, it was announced. It is expected to be in operation about Feb. 1, 1954. This will make the ninth parts depot Caterpillar operates.

Italy's New Diesel Truck

Lancia, Italian automobile manufacturer, has recently introduced a lightweight truck, called the Beta, which is powered by a 2-cyl, blower-scavenged 2-cycle diesel engine. The engine, resembling an established American design, operates on the uniflow scavenging principle and has a bore and stroke of 3.9 in and 4.9 in respectively. Piston speed is 1643 fpm at the maximum speed of 2000 rpm.

The blower is of the Roots pattern with two 3-lobe rotors, speed of which does not exceed 3200 rpm. Combined injectors and fuel pumps are on the cylinder head, mounted centrally over each cylinder. They are driven by pushrods from the camshaft fitted low in the cylinder block.

ARBA Annual Meeting

The 52nd annual meeting of the American Road Builders' Assn. will be held in Atlantic City, Jan. 5-7, it was announced. Planned to provide broad reports and discussions of new developments in all phases of the highway field, the meeting is expected to be unusually significant because Congress and many state legislatures will be preparing to tackle measures dealing with increased highway needs, including expansion and changes in federal aid programs.

Rock Island Opens Diesel Shop

The Rock Island Lines announces the opening of its newest and most modern diesel shop facility, located in Chicago for the maintenance and repair of diesel locomotives operating in and out of the area. The $1 million installation is replacing a roundhouse which was built before the turn of the century.

The 8-track shop will accommodate 16 diesel units. Tracks, elevated from the main floor, are over pits. Platforms at engine floor level make for easy access to upper engine sections. Equipment also includes a hydraulically operated table to remove or install engine trucks. The shop ventilation system is an efficient one, providing for expelling of gases and intake of fresh and warm air. Mercury vapor lighting is used in repair areas, flourescent lighting elsewhere.

DIESEL BRIEFS

Superior Diesel To Liberia

The National Supply Co. has been awarded a contract to furnish a Model 65-SX-8, 8-cyl Superior diesel to the Krutown power plant of Monrovia Port Management Co., Ltd., in Monrovia, Liberia, West Africa. The turbocharged engine, rated 1765 bhp at 600 rpm, will drive a 1250-kw, 3-phase, 60-cycle, 3-wire, 2400-v generator, bringing the plant's capacity up to 2450 kw.

Selection of the new Superior is attributed to the economical performance of three Model 60, 625-bhp units purchased in 1950. Designed for heavy-duty service, the Model 65 is available either naturally aspirated or supercharged and can be fitted with dual-fuel equipment where gas fuel is available. The Liberia company manages and supplies municipal services to the city and port of Monrovia.

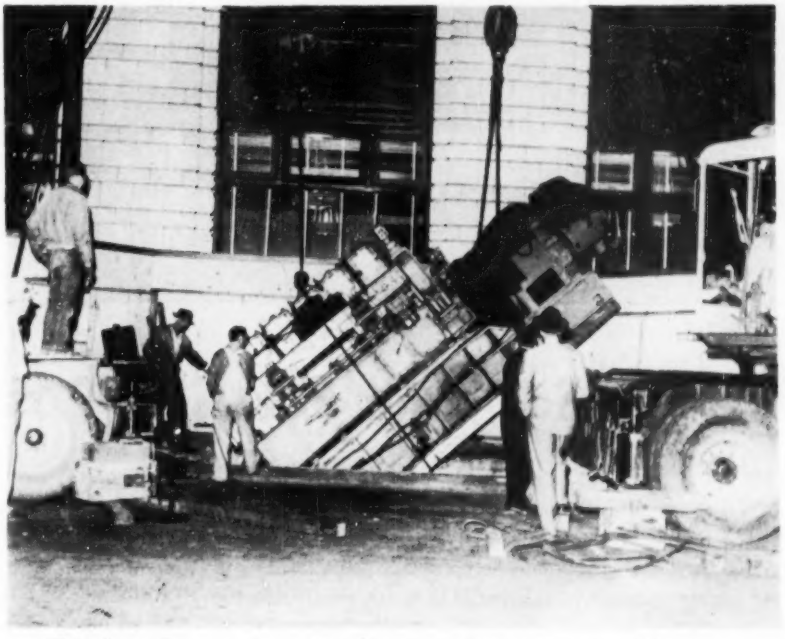
More Diesels For Irish Rails

Coras Iompair Eireann (Ireland's Transport Co.) announces that it is planning to purchase 105 diesel locomotives in its locomotive fleet expansion program for 1954. The program includes 90 diesels between 550 hp and 1400 hp for high-speed trains and 15 between 250 hp and 350 hp for lighter service.

Ireland's experience with diesel trains has shown that they can be operated at about 25 per cent less than the average cost of steam traction. The diesels are averaging 310 miles, while the average daily mileage of steam locomotives is about 125.

New Alco Diesel Parts Depot

American Locomotive Co. announces it will build a warehouse and office building in St. Louis, Mo., which will serve as its diesel locomotive parts storage depot in the Southwest. The warehouse is expected to be completed next spring at an estimated cost of $400,000. Provision will be made for the possible erection of a diesel engine and locomotive component rebuild and repair shop.



Tight Squeeze Relieves Pinch on Power

When an ordinance in Seattle, Washington, limited sidewalk openings to 6 ft by 12 ft, riggers with the job of installing this large Cooper-Bessemer diesel literally had to put the "square peg through a round hole". Only by standing the 13-ton diesel engine on end was it possible to lower the heavy unit, clearing the opening by inches.

The Cooper-Bessemer diesel-electric generating set is a standby power unit installed by the Pacific Telephone and Telegraph Building in Seattle, Washington. The independent electric generating unit starts up automatically to keep telephone and telegraph services going in the event of power failure for any reason.

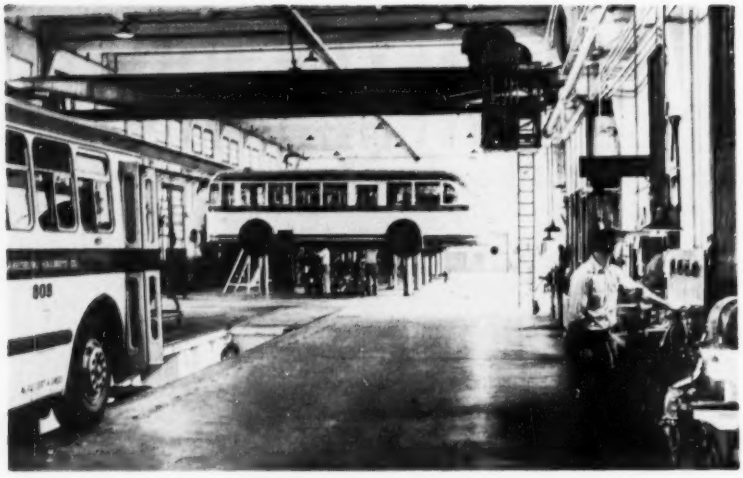
New Concept in Plant Planning

Today's factory owners are forsaking the ancestral corporate home and are demanding that their new industrial plants consist of the minimum amount of building required to cover a mechanical process. Translated literally, this means putting a shell over machines, according to Frank L. Whitney, chief engineer, Walter Kidde Constructors, Inc.

This new concept in the basic purpose of an industrial plant—flexibility, expandability, and even demountability—is having an influence on construction materials, and the trend appears to be away from materials which do not lend themselves to easy change or expansion. "The logical approach to this problem," Mr. Whitney states, "is a wall which can be economically expanded or revised as the production facility is expanded or revised."

Sealed Power Expands

A major move in its replacement parts business was revealed by Sealed Power Corp. with the announcement that it has sold the front end and chassis parts phase of its business to Moog Industries, Inc. The transaction is part of an expansion program on its piston ring, piston, cylinder sleeve, valve, and water pump line, to streamline its operation by specializing in these engine parts which have been the backbone of its operations since 1911.



Well-planned preventive maintenance schedules are of prime importance at Harrisburg Railways. As can be seen in this illustration, clean, well ventilated shops are part of maintenance too.

By F. C. Burk
E. S. Black
L. J. Test

The Atlantic Refining Co., Philadelphia, Pa.

Abstract of a paper presented to a Session on Motor Fuels during the 18th Mid-Year Meeting of the American Petroleum Institute's Division of Refining.

Which Fuel For City-Bus Operation . . .

THE transportation industry, regardless of whether it is represented by steamship, railroad, bus, truck, or air, is faced with the complex problems associated with our highly competitive system. This is not peculiar to the transportation industry alone, but extends throughout all types of business. Fortunately for all of us, because of this system, we advance or progress toward higher efficiency and decreased cost, or we obtain improvement in produce quality.

In order to achieve these gains, it is imperative that each business—or, in this case, each form of transportation—study very closely its existing operations for the purpose of seeking ways to improve its service or to decrease its costs. An example of such studies has been demonstrated by the railroad industry when it changed from steam- to diesel-powered locomotives. The economies resulting from this change have been well-established.

City-bus operators are also keenly interested in reducing their operating costs, as they are faced with increased equipment and labor costs. At the same time they are faced with real resistance on the part of the public utility commissions as well as the public to increased fares necessary to offset the higher operating costs.

Fuel cost represents a substantial part of the operating cost. Therefore it is logical that a progressive operator will take a very careful look at the potentialities of any fuel system which may result in a fuel saving. The three fuel types presently available for bus operators are gasoline, diesel fuel, and liquefied petroleum gas (LPG).

Unfortunately, although much information on the economies of these three fuel types has been presented in the literature, it has been difficult to draw conclusions from these reports. The main reason for this, to our knowledge, is that no data have been published on tests made using the three fuel types in comparable equipment with substantially identical side-by-side operation. Information obtained on one type of fuel in one part of the country should not be compared with results on a similar fuel in a different operation and location if true comparisons are to be obtained.

In discussing this problem with the Harrisburg Railways Company, Harrisburg, Pa., the conclusion was reached that published information on the relative economies of gasoline, diesel fuel, and LPG was inadequate. To obtain answers to the problems for that company's particular operation, it was agreed to conduct a joint investigation to obtain the desired information.

To this end a program was prepared whereby new equipment designed for each fuel type would be purchased and put into Harrisburg's normal service. Selection of the equipment was confined to units of comparable size and of the type which had been previously used in that company's operation. Observations were to be made throughout the test relative to fuel economy, maintenance costs, and performance. Information on driver reaction and public acceptance was also to be obtained.

Equipment

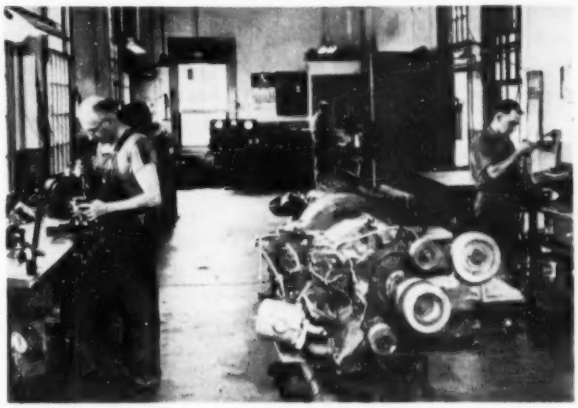
Twenty new buses were purchased. Of these, 10 were diesel, 5 gasoline, and 5 LPG. They represented the latest designs offered by the manufacturers for the three fuel types. In addition two older gasoline-engine buses were converted to use LPG.

Diesel buses were GM 36-passenger units powered by the series 4-71 engine which has a piston displacement of 284 cu in and a compression ratio of 17.1:1. This engine develops 133 bhp at 2000 rpm. These units were rear-mounted and incorporated a remotely-controlled drive through a vee-drive fluid clutch to the rear axle.

Twin Coach, Model 38S, 37-passenger vehicles were

A two-year test, conducted jointly by the authors and the Harrisburg Railway Company, to determine the most economical fuel for city-bus operation proved the diesel more economical than LPG or gasoline.

Harrisburg Railways considers well-lighted shops a part of good preventive maintenance practice also. This engine was used in the test run.



LPG? Diesel? Gasoline?

selected as the gasoline-powered units. The engine for these units was a Model 180-1, having a compression ratio of 7.3:1 and a piston displacement of 404 cu in. This is rated 180 bhp at 2800 rpm.

LPG-powered buses were also Twin Coach, Model 38S, 37-passenger units. The LPG. engine was a Model 180-17. Its piston displacement was 404 cu in, compression ratio 9.65:1, and it developed 198 bhp.

The two engines converted from gasoline to LPG were Model 136 Hall-Scott units. Piston displacement for these units was 477 cu in and after conversion to LPG, the compression ratio was 8.95:1.

Fuels

Commercial regular-grade diesel fuel and gasoline of high quality were used throughout the test in the diesel- and gasoline-powered units. The LPG used was essentially a high-quality commercial propane. Typical inspections of the diesel fuel and gasoline are given in Tables 1 and 2. Properties of the commercial propane are given in Table 3.

Lubricating Oil

All engines used U. S. Army 2-104B type of lubricating oil for the bulk of the test. Oil was changed every 3000 miles in the diesel buses for the first 1½ years of operation. The oil-change interval was then increased to 6000 miles so that it would be comparable with that used in the gasoline and LPG units. This simplified the servicing of each type of equipment and experience indicated that the previously used 3000-mile oil-change period could be extended.

Operation

Units on test were operated on the regular schedule used by the other non-test vehicles. Although actual routes

TABLE 1

Diesel-Fuel Inspection Data

Gravity, deg API	39.5
Sulfur, per cent	0.16
Flash point, Pensky-Martens	120
Ignition quality, cetane No.	50
ASTM distillation (fahrenheit):	
Initial boiling point	300
50-per-cent point	460
90-per-cent point	550
End point	620

TABLE 2

Gasoline Inspection Data

Gravity, deg API	60.7
Sulfur, per cent	0.06
ASTM octane number, research method	88.0
ASTM distillation (fahrenheit):	
Initial boiling point	110
10-per-cent point	140
50-per-cent point	230
90-per-cent point	335
End point	400

TABLE 3

Commercial Propane

C_3 content, per cent (minimum)	95
Vapor pressure at 105 F, psi (maximum)	225
Hydrocarbon residue, per cent (maximum)	2
Non-volatile materials (1,000 ml):	
Residue boiling above 100 F, milliliters (maximum)	0.5
Oily material	None
Corrosion test (copper), 3 hours at 122 F	Negative
Water content (cobalt bromide)	Dry (blue)
Hydrogen sulfide	Free
Mercaptan sulfur	Free
Total sulfur, grains per 100 cu ft (maximum)	12

changed from time to time, all test units were scheduled to cover the same course so that the operation would be comparable between fuel types. Drivers were also changed according to their regular schedule; hence all buses were subject to the normal driver differences in operating techniques.

These vehicles were put into operation in January 1951, and were taken off test 2 years later. During this period each of the new buses had been operated about 80,000 miles.

The mileage covered by the LPG conversion units was considerably lower because of an accident with one of them and because of unforeseen mechanical difficulties with the other. For this reason the results of the test will be confined to the new equipment, except with respect to fuel-consumption data.

Although the original program called for operation of the vehicles until engine overhaul was necessary, it was deemed advisable, for several reasons, to terminate the test after two years' operation. The first of these reasons was that sufficient operating experience had been acquired to provide a valid basis of comparison on each of the three fuel types. The second reason was that the operating economies were also sufficiently well defined for each fuel type to indicate which type was the most economical.

Maintenance

Maintenance of test units was no different from that used for other vehicles. However, Harrisburg Railways is unique in that its facilities and maintenance programs are definitely superior to those found in many other operations. For example, an engine tune-up is made on every bus at scheduled 6,000-mile intervals.

Tune-up includes adjustment of valve clearances and the checking—on Harrisburg's own chassis dynamometer—of the ignition system and air-fuel ratios under idle and load conditions. Power and mileage checks are also made, and timing is set for best performance. Similar performance checks were made on the chassis dynamometer for the diesel and LPG units.

Accurate records are maintained on all material requisitioned, as well as on labor charges for each bus. Also fuel and oil additions are adequately recorded. Immediate attention is given to any operating difficulty, and skilled personnel is assigned to correct the trouble as soon as possible.

Costs

To arrive at the overall cost picture prior to reporting on the results, it may be well to cover in some detail the investments associated with the equipment, storage facilities, and fuel costs. These figures apply to this particular operation and geographical location. They do not necessarily reflect costs in other operations. However, equipment and maintenance costs should be comparable for equivalent bus operation in other fleets.

VEHICLES—The original cost of each bus, in round numbers, for each fuel type was as follows:

Gasoline	$15,000
LPG	15,375
Diesel	15,750

Because of these slight differences in new equipment costs, and because of the different methods which can be used by other operators to arrive at depreciation figures, depreciation *per se* has been omitted from the cost comparisons in the results. Had depreciation been included, all types would have been written off at about the same rate.

FUELS—The cost of the fuels reflects some changes in price structure during the test program. The costs shown were weighted according to the length of time used for a given period of operation. Included in the fuel costs are state and federal taxes. LPG fuel costs are those prevailing in the Harrisburg area, and they undoubtedly differ from LPG fuel costs in other parts of the country. Fuel costs are as follows:

	Cents per Gal
Gasoline	19.7
LPG	16.3
Diesels	17.6

LUBRICANTS—Lubricating-oil quality was changed early in the test; *i.e.*, a oil below U. S. Army 2-104B quality was changed to an approved U. S. Army 2-104B quality. The cost of the lube oil was slightly in excess of 50 cents per gal.

FUEL STORAGE AND HANDLING EQUIPMENT—Fuel storage and dispensing equipment for the gasoline- and diesel-fuel systems were available at Harrisburg Railways Company. It is customary for fuel suppliers to provide these facilities at no expense to the operator.

However, storage and dispensing equipment for LPG were not available and it was necessary for the operator to purchase and install them. Excess storage capacity was provided at the start of the test in order to accommodate additional LPG buses which might be added to the fleet at a later date. The excess storage capacity also provided facilities for less frequent deliveries of LPG.

The cost of the LPG storage tank of 15,000-gal capacity and its associated equipment and installation amounted to $12,250. In addition, insurance authorities were pressing Harrisburg Railways to install high-capacity ventilating fans and ducts in the stop area for safety. This would have resulted in a further expense to handle LPG on a continuing basis. This investment was not made pending the results from the test program.

Results

Fuel: Average fuel consumption figures for the first and second years and the average fuel consumption for the test period are given in Table 4.

Lubricating Oil: The average oil-consumption figures are based on total oil added at the oil-change periods plus makeup. Oil consumption data are given in Table 5.

Maintenance: Complete maintenance records were kept on the parts and labor required for each type of bus. Maintenance costs shown in Table 6 have been calculated to the nearest dollar per 1000 miles of operation.

TABLE 4

Fuel Consumption

Type of Fuel	Average Mileage Per Gallon, First Year	Average Mileage Per Gallon, Second Year	Average Mileage Per Gallon for Test
Diesel	5.65	5.53	5.59
Gasoline (Twin Coach)	4.10	3.94	4.02
LPG (Twin Coach)	3.37	3.35	3.36
LPG (ACF), conversions	2.34	2.70	2.52

TABLE 5

Oil Consumption—Average Miles Per Quart

Type of Fuel	First Year	Second Year	Average for Test
Diesel	127	139	132
Gasoline (Twin Coach)	224	152	188
LPG (Twin Coach)	299	200	250

TABLE 6

Maintenance

Type of Fuel	Average Cost Per 1,000 Miles
Diesel	$20.00
Gasoline (Twin Coach)	22.00
LPG	27.00

TABLE 7

Average Costs Per 1,000 Miles

Vehicle Type	Fuel	Oil	Maintenance	Total
Diesel	$31.50	$.95	$20.00	$52.45
Gasoline	49.00	.60	22.00	71.60
LPG	48.50	.50	27.00	76.00

TABLE 8

Costs for 200,000 Miles of Operation (5 Years)

Vehicle Type	Fuel	Oil	Maintenance	Engine Overhaul	Total
Diesel	$6,300	$190	$4,000	$900	$11,390
Gasoline	9,800	120	4,400	600	14,920
LPG	9,700	100	5,400	400	15,600

The actual LPG maintenance cost was contrary to what had been expected and does not confirm other published information. These costs, however, represent those which might be obtained by other bus-fleet operators who are using LPG fuel for the first time. Data in Tables 4, 5, and 6 are summarized in Table 7.

It is recognized that the data in Table 7, do not present the complete picture of total operating costs because depreciation costs are not included—and perhaps, more important, engine rebuilding costs have been neglected. As mentioned previously, the test was terminated before it was necessary to consider engine rebuilding.

Fuel and oil consumption was at acceptable levels for all test buses; in fact, after over 100,000 miles of operation, gasoline and diesel buses are still in operation and are not yet in need of overhaul. Presumably this would have been true for the LPG units had they continued on test.

In order to arrive at an estimate of what the total operating costs would have been had the test continued to an engine overhaul period, it is necessary to make some assumptions. Admittedly these assumptions are not based on fact but, rather, on estimates.

Engine overhaul costs for the gasoline engine are known to be about $400, and the frequency of overhaul is approximately every 150,000 miles. Diesel-engine overhaul is expected to cost about $450, and for the purpose of this comparison has been based on an overhaul at the 100,000-mile point. LPG-engine overhaul has been estimated to be comparable to the gasoline engine, and its frequency is assumed to be at the 200,000-mile point.

Using these figures, Table 8 has been prepared for 200,000 miles of operation, and the relative overall operating costs have been included. It should also be reemphasized that the increased storage and dispensing costs of LPG have not been included in these cost comparisons.

(*In noting Table 8, it might be well to point out that many bus fleets are operating diesel-powered units as high as 200,000 miles between overhauls. If figured on this basis, Table 8 would reflect even greater economy for the diesel.—Ed.*)

Driver and public reaction: Driver reaction was in favor of the diesel buses because of their improved performance at low speeds. Inasmuch as all buses, when not in use, were stored in heated garages, starting was not a problem. LPG vehicles were the second choice of the drivers based on the fact that power and smoothness appeared to be superior to the gasoline-powered buses.

Passengers and people in the community were apparently unaware that different fuels were being used. No complaints as to excessive exhaust smoke or exhaust odors were received from the public, and careful observation of the equipment throughout the test showed smoke and odor to be absent. This is especially important in connection with the diesels since the aldehydes formed during combustion sometimes become offensive.

Summary

A comparison of gasoline, diesel, and LPG fuels has been made in new equipment designed for each fuel type and in a typical city-bus fleet as represented by the Harrisburg Railways Company operation. Data show that the diesel-fuel system is the most economical. Gasoline is more economical than LPG. However the differences between these two fuels are small.

Acknowledgment

Without the assistance and wholehearted cooperation of Colonel Harley Swift, John Tuten, and Vic Zimmerman of the Harrisburg Railways Company, this work would not have been possible. The authors wish to acknowledge the helpful counsel of these gentlemen and publicly to thank the Harrisburg Railways Company for the time and effort it has contributed to this project.

Fig. 1 A 10-cyl opposed-piston engine served as the experimental unit. It was equipped with special instrumentation as follows:
A&B—Diaphragm pressure-recording pick ups
C&D—Crosby-type steam engine indicators
E—Nichrome ignition element

By R. O. Montenero*
Fairbanks-Morse and Company

Containing Crankcase Explosions

A discussion of the results of a development program directed toward eliminating the damage resulting from occasional crankcase explosions. A brief review of the theoretical aspects of an explosion, a description of engine design modifications, experimental tests, and field experience with the redesigned engine are given.

CONSIDERING the large number of diesel engines in use, the percentage of crankcase explosions is extremely small. The increase in the total number of these mishaps however is due to the extraordinary growth of the use and application of diesels.

Many such explosions have been of a minor nature, but a few have made prominent headlines due to the serious damage resulting. While publicity tends to exaggerate the danger, it is important to discover methods of reducing such risks.

Theoretical Aspects

Available authentic literature indicates a general consensus that the crankcase atmosphere in a normally operating diesel engine is primarily composed of lube oil droplets or mist suspended in air by action of moving parts within the crankcase. Danger of explosion is introduced when heat generated locally from some mechanical derangment (within the engine) vaporizes sufficient quantities of oil particles to form an explosive mixture, and subsequently furnishes the additional heat necessary for ignition.

However, the presence of these essential conditions does not mean that a violent crankcase explosion will always occur. Circumstances involved in actual explosions have convinced most observers that a sealed crankcase mixture is too rich for a severe explosion.

Damaging explosions and fires have occurred after a cover has been removed either by pressure from a preliminary mild explosion or by someone inclined to investigate some mechanical malfunction too soon after the engine was shut down. Such cover removal permits an additional amount of air to enter the crankcase, thus making the mixture sufficiently lean so as to be highly combustible, and causes a more severe second explosion.

Preventive Measures

Various measures have been adopted which have definitely reduced the frequency of crankcase explosions, while other precautions have successfully limited damage from pressure and fire when an explosion does occur. They include the following:

1. Parts design has been improved along with selection of more suitable material so that conditions contributing to "hot spots" are reduced.

2. Emphasis is placed on good maintenance and adequate instruction so that engines will not be operated with excessively worn, broken, or improperly assembled parts.

3. A sufficient number of lightweight relief valves are provided to relieve the pressure of initial explosion and thus prevent a dangerous inrush of fresh air.

4. Crankcases are thoroughly ventilated so that the vapor mixture will always be too lean to ignite. This requires large inlets into the crankcase, correctly located so as to avoid unventilated pockets behind stress members in the crankcase construction which tend to act as baffles.

**Abstract of an article presented by the author at the Annual Meeting of the American Society of Mechanical Engineers before the Oil and Gas Power and Railroad Divisions.*

Proper air filtration is also necessary to keep contaminants out of lubricating oil; oil leakage and the need for proper oil separators presenting added problems.

5. Engine shut-down devices are installed that are actuated by a pressure rise in the crankcase. This stops the engine to prevent further overheating of ignition source.

6. The crankcase is strengthened to withstand the force of an explosion. This is possible for both new and old engines where only redesign of covers is necessary. On very large slow-speed engines with large surface areas or where crankcase doors are too heavy to handle, this may not be feasible.

Maximum Pressure to be Maintained

Since no practical method has been found to completely eliminate the possibility of these explosions, Fairbanks, Morse & Co., in addition to improving designs and materials, has directed its efforts towards containing them and thus to eliminate the external damage and safety hazards accompanying the accidents. After study, it was concluded that an engine designed to contain approximately 100 psi without rupture could withstand the explosion.

Calculations of a theoretically complete combustion of an optimum fuel-air mixture indicate that slightly higher pressures could exist. However, evidence gathered from actual explosions in tests using large closed volumes charged with propane and methane indicated that pressures do not exceed 100 psi. This approximate value has also been reported by other investigators.

In an engine crankcase there are several factors which tend to reduce this maximum explosion pressure below the 100 psi obtained in experiments using propane or methane gas. For example, lube oil is a heavier hydrocarbon with a corresponding lower heating value per pound than these gases. Better heat dissipation is also provided by an engine crankcase since it has more surface area per unit volume than the test bombs.

Design Modifications

Taking the above factors into account, it was considered that the F-M opposed piston locomotive engine was capable of withstanding pressures encountered in a crankcase explosion, provided that the crankcase access covers and oil pan sub-base were redesigned.

The contour of the top crankcase cover was therefore changed to a semi-cylindrical shape in order to utilize the hoop strength of this design. The size of the capscrews securing this cover was changed from $\frac{3}{8}$ in to $\frac{1}{2}$ in and the spacing changed from 6 in to 3 in.

To provide added strength, the forward end covers and flywheel end covers were changed from pressed steel to ribbed cast aluminum, and here too capscrews were increased in diameter from $\frac{3}{8}$ in to $\frac{1}{2}$ in. All spring-loaded pressure relief valves were eliminated. The lower

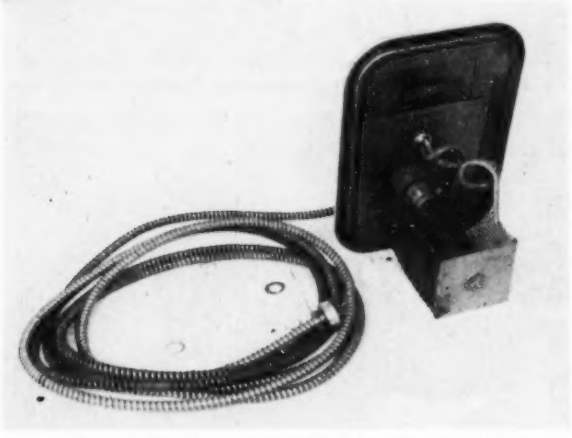


Fig. 2 Lower crankcase cover equipped with caloric element.

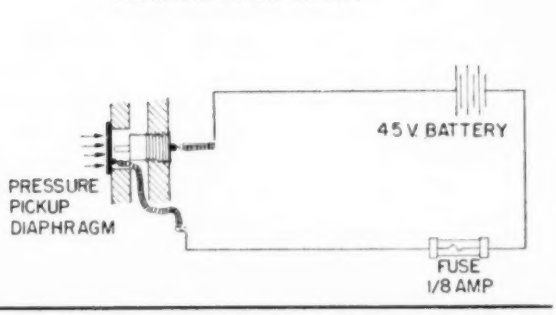


Fig. 3 Nichrome element circuit for simulated engine "hot spot"

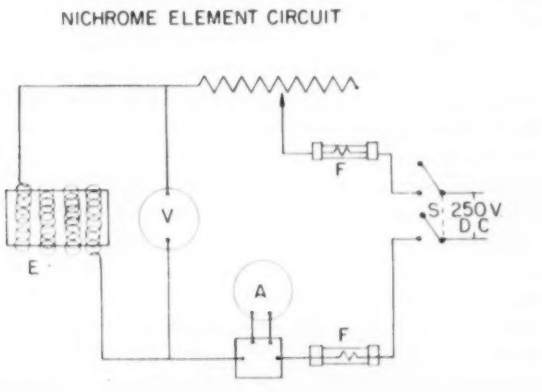


Fig. 4 Pressure pick-up circuit

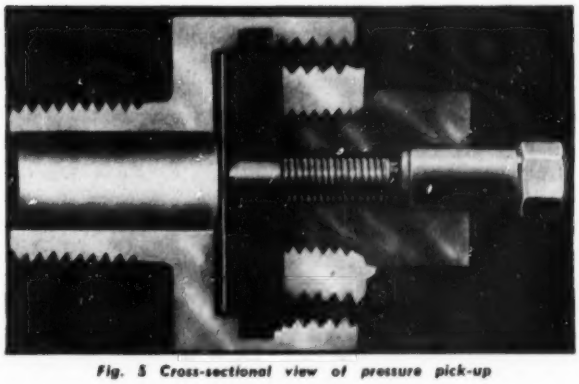


Fig. 5 Cross-sectional view of pressure pick-up

crankcase inspection covers, originally of a pressed steel assembly with a clamping arrangement securing them to the block from the inside of the crankcase, were greatly strengthened by applying 5/8-in studs to the outside of the block near all four corners of the covers. The covers were secured with steel lugs and nuts as shown in Fig. 1.

The welded steel sub-base was reinforced by the addition of internal and external gussets to the sides. These combined changes to increase strength were made in such a manner that additional weight to the complete engine was negligible. Reinforcement of covers, incidentally, resulted in another advantage, a virtually oil-tight engine.

Laboratory Tests—Superinduced Explosions

To evaluate the advantages of the design changes, preparations were made to produce explosions in an engine and to observe the resulting pressures. Selected for the tests was a 10-cyl, 8 1/8-in bore by 10-in stroke, 2-cycle engine used in F-M 2000-hp locomotive units. This engine has a breather connected to the blower suction to maintain a vacuum of 1 to 2 in of water in the crankcase. Special instrumentation was provided as shown in Fig. 1.

A "hot spot" in the engine was simulated by passing a remotely controlled electric current through a nichrome resistance element located inside the lower crankcase. (Details of this heating element are shown in Fig. 2.) The element consisted of 16-gauge nichrome wire with a resistance of 6.5 ohms and was wound on a ceramic spool. It was energized by a 250-v DC power source with a variable resistor, as shown in Fig. 4.

The diaphragm-type pressure pick-up units (cross-section shown in Fig. 5) have a .005-in thick steel diaphragm which is used as a working element. This, when deflected by a predetermined calibrated pressure, contacts the center electrode. The contact closes a circuit containing a 45-v "B" battery and a 1/8-amp fuse in addition to the pressure pick-up. (Fuse circuit is shown in Fig. 3.)

These elements were installed in groups of six in the crankcase covers (shown in Fig. 6). In each cluster of six, one element was calibrated for one of the following pressures: 5, 10, 20, 30, 40, and 50 psi. With this arrangement, it was possible to bracket the maximum pressure of the explosion by observing the blown fuses in the individual element pick-up circuits. (Fig. 7 shows the type of fuse and battery used in the test.) This type of pressure-indicating equipment was selected because of the relatively low inertia forces involved in moving the thin steel diaphragm only a few thousandths of an inch.

In addition to the diaphragm-type pick-ups, the engine was equipped with two Crosby-type steam engine indicators (shown in Fig. 8), one mounted in the upper crankcase cover and the other in the lower. It was recognized that these units are affected by inertia forces, but it was considered advisable to use them as a check against the diaphragm instrumentation system.

In the first test, the engine was operated at 850 rpm (full-rated speed) at 50 per cent load. After engine conditions were stabilized, the "hot spot" was energized and

(*Continued on page 79*)

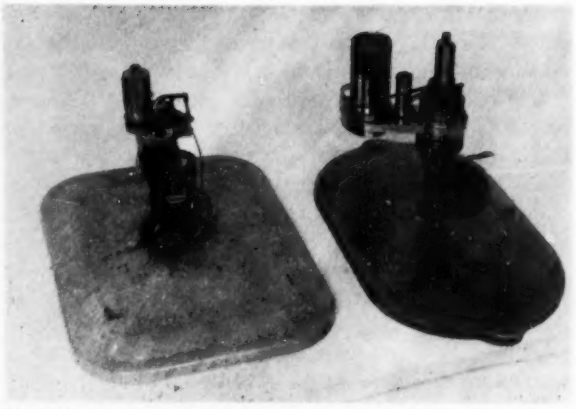


Fig. 6 Upper and lower crankcase covers equipped with pressure pick-ups

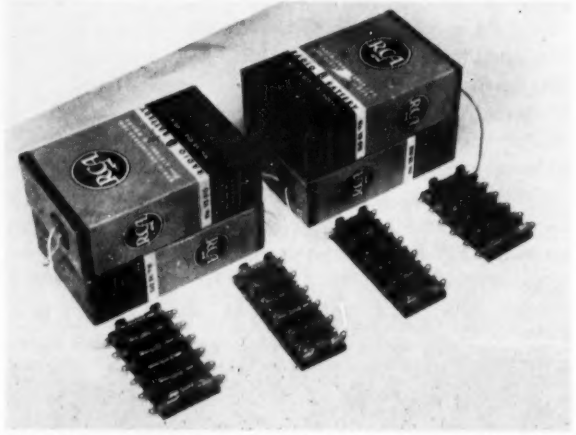


Fig. 7 Power supply and fuse brackets used in pressure pick-up circuit

Fig. 8 Upper and lower crankcase covers with bar spring indicators

TEST NO	OIL TEMP	LOAD BHP	PRESSURES - PSIG PICKUPS	DRUM INDICATOR
1	160	1060	10<P<20	19
2	180	1060	10<P<20	
3	200	1060	10<P 20	14
4	215	1340	10<P<20	
5	230	1740	10<P<20	11

Fig. 9 Table of results

Annual LMOA Convention Proceedings

A large attendance at the 15th Annual Locomotive Maintenance Officers Association Convention, recently held in Chicago, proved that there has been no lessening of interest in the desire to learn what is being done by others to solve diesel-electric locomotive maintenance problems. A brief rundown of the program and committee topics is given.

REGISTRATION of members at the 1953 Annual LMOA Convention was well over 1000. Approximately 25 per cent of the total was other than railroad officials or supervisors. This minority group represents equipment manufacturers and plays an important part in an assembly of this sort. Frequently these people are called upon during the discussion periods to answer a question concerning their equipment or to comment.

The first committee to report was the committee on personnel training. Rather than a totally new topic, this paper was considered a supplement to papers presented by this committee at the two previous meetings. These were entitled "How to Create Interest" and "Apprentice Training", and were presented in 1951 and 1952, respectively.

The 1953 topic, "Methods Used to Train Personnel for Maintaining Diesel Locomotives", received careful consideration by the executive committee before selection since improved methods of training personnel in the proper maintenance of diesel-electric locomotives are needed. The main problem seems to be the fear of complxity of the diesel units on the part of maintenance personnel.

Next on the agenda was the report of the diesel-electrical committee on "Flashovers" and "Rewiring of Diesel Locomotives." From the discussion on flashovers, it was concluded that there was no single solution to the flashover problem and that in addition to more careful maintenance of electrical gear, overhead wiring should be employed in diesel locomotive units. The latter would eliminate the possibility of flashovers due to oily or wet wiring.

As mentioned previously, the second topic of the electrical committee was "Rewiring of Diesel Locomotives." This was a timely topic since many roads are finding it necessary to rewire diesel units earlier than originally expected. In conclusion, it was stated, "Great improvement can be made in service life of wiring and reduction in cost of flashovers by removing all wires from the floor and running them overhead".

Current topic of the committee on shop practices was "Inspection and Maintenance of Diesel Wheels, Axles, and Roller-Bearings". In view of the importance of this subject, it was necessary to compile a fairly lengthy paper. It was the opinion of the committee that the inspection of wheels should first start at the mill and that all wheels received by the railroads be free of mill scale in order to eliminate the sandblasting and shotblasting necessary to clean the wheels for inspection. Slides illustrating various conditions and causes were shown during the presentation.

Another timely paper was presented by the shop planning committee entitled "Scheduling and Flow of Work in Centralized Diesel Shop." This report dealt briefly with the utilization of existing facilities, such as steam locomotive heavy repair backshops for scheduled heavy repairs. Scheduling units into the shop for periodic inspections and planned repairs was also discussed at some length. The latter is of prime importance if the shop is to function smoothly and not be overloaded during some periods and slack at others.

A comprehensive paper on "Economical Reconditioning of Diesel Locomotive Parts" was presented by the committee on diesel reconditioning and control. Discussed here were the economies of metallizing, welding, and chrome plating of locomotive parts. In summarizing the report it was stated, "Careful training of shop personnel, skillful supervision, and the intelligent use of proper tools have been the most important factors in the fine progress achieved, and the outstanding economies realized by the special shops in the reclamation of diesel parts to date."

Metered Maintenance At Broken Bow, Nebraska

By L. E. Clark
Superintendent of Utilities, Broken Bow, Nebraska

Today, more than any time in the past, modern diesel generating stations require adequate and well-planned maintenance programs. Competition and increased costs are a couple of reasons—higher rated engines another.

THERE is a definite need for good maintenance procedure if power production costs are to be kept down. A few years back the users of electrical energy could afford to pay for higher cost per kw hr since very few appliances were in use and electric lights were the main service.

Also at this time, diesel plants enjoyed the advantages of low labor and fuel costs and in addition, lower maintenance costs. Generating equipment was of the slow speed type, built heavy, and had little in the way of precision fitting. Pressures and temperatures were low and even unbalanced conditions could be tolerated without too much harm being done.

Now, with newer generating units installed in our plants, temperatures, pressure and speeds unthought of in the old days, must be considered. The same amount of cast iron, steel or light metal will deliver several times the horsepower now, but operating conditions must be uniform and correct according to the manufacturer's recommendations. Also, many additional pieces of equipment such as pumps, blowers, and coolers have entered the maintenance picture.

Instruments for Records

In the larger plants, a large number of instruments are necessary to produce all the information required for the records. For example, one dual-fuel engine will require a running time meter; inlet and outlet water thermometers; inlet and outlet oil temperature indicators; exhaust pyrometers; lube, fuel, water, and pressure gauges; and a gas flow meter.

Switchboard instruments to indicate the most important items of load being carried by the unit such as totalizing meters for kw hr, hours operated, fuel oil consumption, gas consumption, etc., are also needed to supply sufficient information for good records.

Records

Confining ourselves to the small dual-fuel generating plant, the following records should just about fill the needs: daily log sheets, daily summary of log sheets, monthly summary of log sheets, maintenance schedule and record, maintenance card file, and inventory records for fuel and lube oil.

In some plants, daily log sheet records are found to be very scanty, while in other plants they become quite detailed and impressive. Those on the impressive side, while containing superfluous information in many cases, lend to the dignity of the operator's job and portray his responsibilities.

In either case, daily log sheets should contain sufficient information. The plant manager, chief engineer, or the next operator to come on shift should be able to tell from the log sheet the overall plant condition. It is important that daily totals be computed for kw hr, time operated, fuel, and lubricating oil consumed.

Further computations from this information should be made at regular intervals producing values of Btu per kw

An exterior view of the municipal utilities power plant at Broken Bow, Nebraska. Here, the engine hour meter is used to schedule preventive maintenance.

No. 1———— No. 3———— BROKEN BOW MUNICIPAL UTILITIES 4 Weeks Ending————195—

No. 2———— No. 4———— POWER PLANT MAINTENANCE PROGRAM No. 5 Chief————

Operators Swing

Interval	DUTY (Day of Week / Date of Mo.)	Last Done	Next Due	Shift No.	1st Week S M T W T F S	2nd Week S M T W T F S	3rd Week S M T W T F S	4th Week S M T W T F S	Work OK'd
	1000 K. W. Unit No. 5 1460 H. P. Engine	Daily Time Readings							
1000	Clean Nozzles			4 & 5					
500	Inspect Crankcase			4					
500	Clean Air Filter			4					
1500	Clean Fuel Filter Disc.			3					
2000	Clean Fuel Filter Bag			3					
1000	Clean Lube Filter Disc.			3					
1000	Clean Lube Filter Screen			3					
1500	Clean Lube Filter Winslow			4					
1000	Clean Supercharger Filter			3					
2000	Change Supercharger Oil			3					
200	Check Governor Oil			3					
100	Check Outboard Brg. Oil			3					
100	Lubricate Linkage			3					
Wk.	Blow Out Generator			3					
2 Wk.	Clean Rings & Commutator			2					
500	Clean Crankcase Breather			3					
500	Check Firing Pressures			5					
200	Ck. All Filters for Water			3					
500	Add Oil to Gas Meter			5					
100	Add Oil to Storage			3					
Daily	Wipe Engine & Generator			3					

List the dates of the maintenance period.
Daily Time Readings written here each day.
These readings are the Time Readings for the time maintenance was last performed and are taken from last schedule.
These readings are obtained by adding the interval to the "Last Done" reading.
Operators assigned to do the work.
Each operator watches for maintenance item to come up by noting the "Daily Time" readings and the "Next Due" readings.
Operator initials or numbers the proper square to indicate work done.

The above chart is typical of those used at Broken Bow. The time interval in the first column is varied in accordance with past experience or manufacturers' recommendations for a particular unit.

hr for pilot oil, Btu per kw hr for gas; kw hr per gal of fuel oil; hp hr per gal of lubricating oil; load factor, and perhaps even fuel, lubricating oil and maintenance costs per kw hr. To a large extent you can determine whether or not your equipment is in good condition by these figures. They can be compared to the factory guarantees, previous records, and to those of other plants.

A monthly summary of daily log sheets and meter readings is probably the best indication of a plant's operation and progress. This provides quick access to the more important information for each month and should be cumulative for the year.

The very act of regular recording should bring the operator's attention to the equipment or instruments that should be watched at regular intervals. This becomes the first step toward a planned routine of operation and maintenance.

Maintenance Records and Methods

In many of today's modern plants, maintenance is still carried on in a rather haphazard manner. This usually is due to the lack of a good working plan rather than negligence. Other plants have elaborate daily, weekly, and monthly schedules of maintenance which are certainly commendable but still may result in under-maintenance or over-maintenance. This is especially true when the use of equipment is intermittent or operating hours are irregular.

Still another plan is used in other plants. This plan consists of conducting a series of tests at regular intervals. Indicator readings are taken regularly for firing and compression pressures. Various micrometer and strain gauge readings are also taken periodically. All of these are plotted and a change in the curve will indicate the time for maintenance of valves, rings, etc.

One other plan of maintenance is that of assigning the various items of duties as they become necessary by the chief or foreman in charge. This kind of maintenance requires constant and keen supervision at all times and can be good or bad, according to the supervision.

Metered Maintenance

The control for this type of maintenance comes from the all-important time meter mentioned earlier. Maintenance is prescheduled and charted in intervals of four weeks. The items to be serviced, such as time interval between servicing, time reading when last performed, time reading when due, and operator assigned, are listed.

Squares are provided for checking off these duties as performed on any day in the 4-week, or other determined, period. Squares are identified both by day and date, and time readings are recorded on the chart daily for each unit. Intervals of maintenance will vary from 100 hr to 2000 hr of actual operation.

Other items can be included, with intervals up to 10,000 hr if considered practical, and most duties will be found to be performed very close to the hour assigned. This all sounds complicated, but works out to be quite foolproof and requires only a minimum of time for supervision.

The 4-week assignments can be worked up by the maintenance superintendent in an hour's time for as many as five generating units. He has before him complete information for the last four weeks and projects all the needed maintenance into the next 4-week interval. If some machines are used more or less extensively than planned, maintenance is automatically geared to the changed program since maintenance is based on engine hours operated.

Metered maintenance works quite smoothly in a plant once it is established. Even operators not fully trained can follow its guide. The operator (or maintenance man in the larger plants) glances over the chart daily and performs the duties assigned to him for the meter readings that appear due. The man in charge knows who did the work, the date and time of reading, and he knows when it is due to be done again. In fact, it would be possible for him to take a 4-week vacation, leaving maintenance well under control until he returned.

Indexed Card File

Other irregular items of maintenance and major overhauls should be recorded on cards and kept in an indexed file. This should be done for each major piece of equipment. Again, time readings are valuable. These should be recorded each time, thus determining the exact operating hours between overhauls.

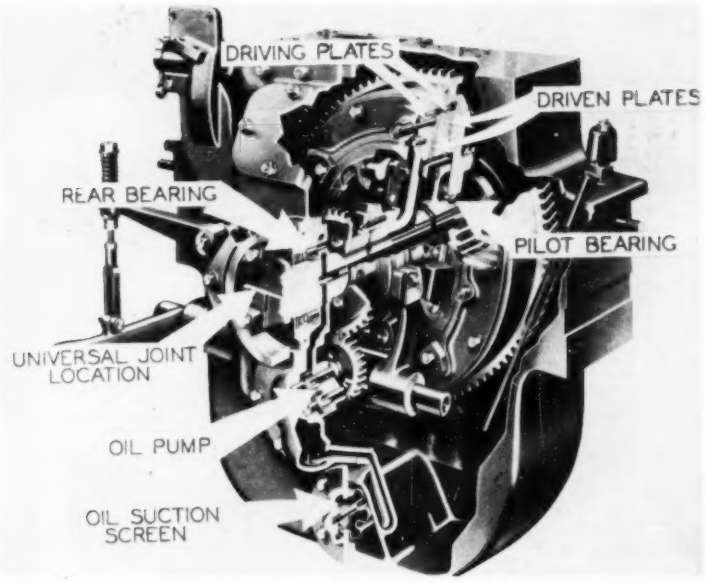
Major overhauls can likewise be spaced on regular and predetermined intervals. A small card file provides a good history and will handle records for years.

Summarizing

Metered Maintenance can accomplish in many of our plants just what we are seeking, the proper balance between under-maintenance and over-maintenance or more often, a combination of both.

Below, operators Lawrence Arnold and Arthur Stewart change filter elements in a lube oil filter as part of the regular metered maintenance program.

Above, operator Lawrence Arnold cleans fuel oil filter on an Enterprise engine after checking the metered maintenance record.



This titled cutaway shows the inner workings of the oil-type clutch, now standard equipment on several "Cat" units.

A recent development of the Caterpillar Tractor Company takes the form of an oil-type flywheel clutch. It will be standard equipment on D-8 and D-6 tractors and No. 6 shovels.

Here, three members of Cat's engineering department look over an oil-type clutch equipped with booster unit for a D8.

Caterpillar's Oil-Type Clutch

DEVELOPMENT of Cat's oil-type clutch represents the culmination of more than 11 years of research and experimentation. The use of oil-type clutches however, is not entirely new to the company. About 1920, the 2- and 4-ton tractors made by the Holt Manufacturing Company, one of Cat's predecessors, used steering clutches and brakes which operated in oil.

However, due to the heavy oils used in those days, difficulties were encountered when the tractors were operated in cold weather. Clutches would not transmit sufficient power to drive the tractors until the oil was heated. Today, with the use of lighter oils, this no longer presents a problem.

How it Works

When the clutch is being engaged, the oil absorbs the entire load up until the last few revolutions before full engagement, at which time the friction faces finally come into direct contact.

Clutch oil is lifted from the reservoir at the bottom of the housing by a positive-displacement, rotary-gear type pump, forced around the clutch shaft, and discharged around the inside diameter of the friction faces. Oil flows through the grooves and slots in the friction faces and pressure plates even when the clutch is engaged.

The oil, when ejected from the outside of the flywheel through radial slots, also provides constant lubrication for the cams, bearings and internal linkage.

Generally speaking, clutches on heavy-duty tractors and earthmoving equipment, such as these units have been designed for, generate exceedingly high temperatures. Therefore, in addition to providing internal lubrication, the clutch oil also acts as a cooling agent for the entire clutch assembly.

Also since friction material operating in oil has a much lower coefficient of friction, the engaging force of an oil clutch must be higher than that of an equivalent dry clutch. On this account, Cat has developed an engaging mechanism with a high mechanical advantage and hardened all of the highly loaded internal parts to reduce the pull required by the operator on the clutch lever.

On the D-8, a booster cylinder has been added. This gives greater ease of control and also provides a shorter clutch lever stroke on this model. The D-6 tractor and No. 6 shovel do not require this booster.

An innovation being introduced with this clutch is a universal joint which eliminates the need for close alignment between the clutch and transmission.

According to G. E. Burks, Chief Engineer at Caterpillar, "this is the first successful oil clutch to be put into use in the crawler tractor field, and it will operate two to four times longer than in equivalent dry clutch before major overhaul is necessary. It is intended that under ordinary operating conditions the overhaul period of this clutch will coincide with the normal overhaul of the engine", Burks added.

Straight from the Tool Box

This is YOUR Department. Pass along your ideas to the other fellow. Send items to the Editor, preferably with a picture or sketch. Contributors will receive $10.00 for each item upon publication.

Licking Sight Feed Clouding Problems

JACK W. MCCURRY, NEEDLES, CALIF.—I am a maintenance foreman for a pipeline compressor station and one of my headaches has been trying to keep the power cylinder lubricator sight glasses clean. The problem gets really rough when using one of the high additive oils. It was necessary to keep one man working on lubricators most of the time. The oil did a wonderful job and we did not want to change to another just because it might be easier to feed; the main thing is for the oil to do a good job in the cylinder.

We tried different mixtures of glycerine and of calcium nitrate, but always got the same answer—trouble. Working with Mr. H. Minnick of Shell Oil and Mr. H. Johnson of Cooper-Bessemer, both from San Francisco, we licked the problem. We use McCord class SF lubricators. In the sight glasses, we inserted their part No. A-25849, called a bobber. No fluid is used with this setup.

The bobbers have been in service over six months and in that time, not one cent has been spent in lubricator maintenance. We are saving about $15 per day and over $4000 per year in reduced maintenance costs. Added to this is the cost of the glycerine or calcium nitrate that are no longer used. Also, we have found it is much easier to calibrate the lubricator with the bobber than by the drop method.

This sounds like an extreme case of what is a persistent problem. The matter of clouding, which became a more acute problem with the expanding use of additive oils for cylinder lubrication, has been a puzzler and the cause of a great deal of research. Everything from Windex to the silicones has been used as fluids, with varying success. As one oil engineer explained, "The detergents dispersants in the oil are doing just what they are supposed to do, except that they work on the fluid and its contaminants when we would like the additives to leave them alone."

The bobber is something relatively new. The way that we get it, the bobber fits in the orifice and lifts on every pump stroke to give positive indication of delivery. The fluid cavity fills with oil but is arranged so that the bobber is always visible. The entire principle of delivery is the same. Calibration is by pump strokes rather than by drops. Thus, the problem of varying drop sizes is eliminated. We're going to dig into this further and you'll hear more later—Editor.

Removing Pipe Plugs

LT. W. C. VAN KIRK, USN, SAN DIEGO, CALIF.—Here is a way to remove pipe plugs, having ½-in square shanks, even if frozen tightly into place or if the corners are damaged. It is a question of getting a good "bite" for increased leverage. Place the ½-in drive end of a socket wrench over the pipe plug shank and drive it home with a soft metal hammer. A good pipe wrench can then be used on the socket to remove the pipe plug.

For hard-to-reach plugs, a hex-shaped piece of stock or a bolt with two nuts locked on the threaded end can be inserted in the nut side of the socket and used as an extension. Regular wrenches can then be used to loosen the plug. A scratch brush to clean away corrosion and use of a penetrant will help.

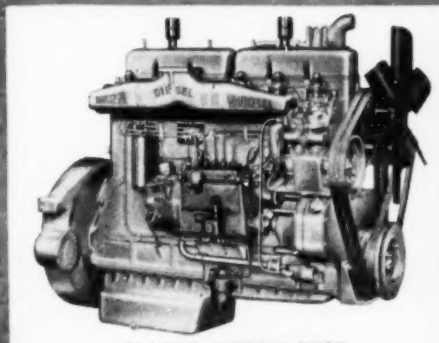
This method has been used successfully for removing zinc pencil plugs from heat exchanger equipment and plugs from cast iron machinery parts.

We have used this idea successfully—and unsuccessfully. In "driving" the socket on the tapered shank, and incidentally doing some broaching, we have cracked and split sockets. You have to watch it. Also, the only "bite" you can get with a pipe wrench on most sockets is where they are knurled or stamped. Then watch out for burrs. That's why we like the second idea of using an extension best. Granted that it's rough on the socket, it is often cheaper to ruin one, providing that you get the plug out, than spend the time required by other methods. Also, it is worth a lot to get the plug out without damage to the casting or threads—Editor.

WAUKESHA

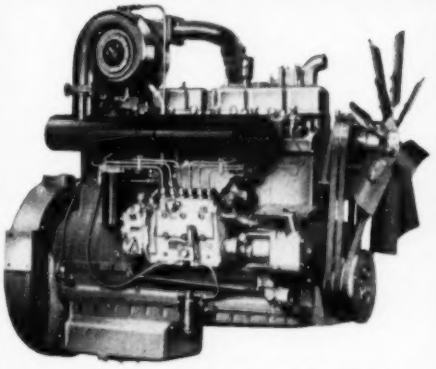
PAYLOAD POWER PLANT

148 *Diesel* -SERIES-145 *Gasoline*



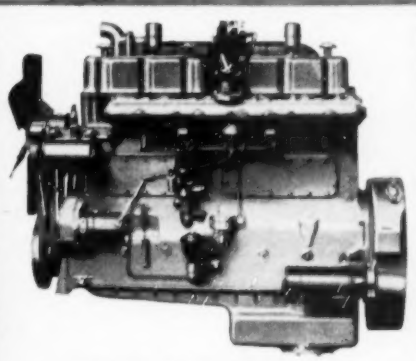
148-DKB—NORMAL DIESEL
779 cu. in. Max. hp 200 @ 2100 rpm.

FAST
SMOOTH
POWERFUL



148-DKBS—TURBOCHARGED DIESEL
779 cu. in. Max. hp 280 @ 2100 rpm.

SEND FOR BULLETINS

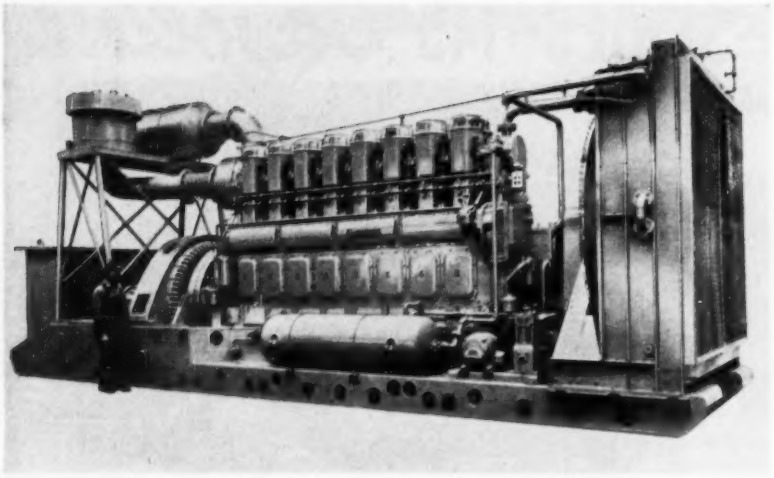


145-GKB and 145-GZB—GASOLINE
779 and 817 cu. in. Max. hp 240 and 250 @ 2400 rpm.

223

WAUKESHA MOTOR COMPANY, WAUKESHA, WIS. • NEW YORK • TULSA • LOS ANGELES

PRODUCT



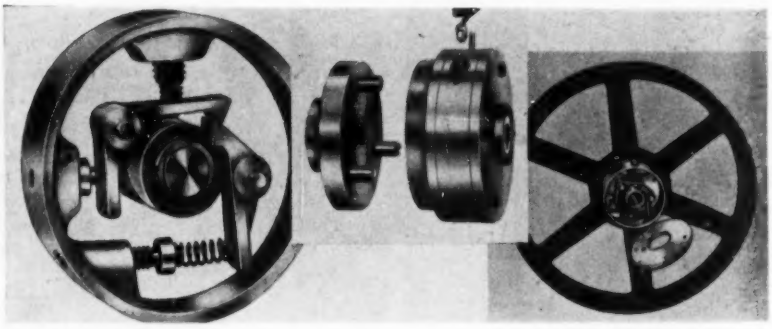
Packaged Units

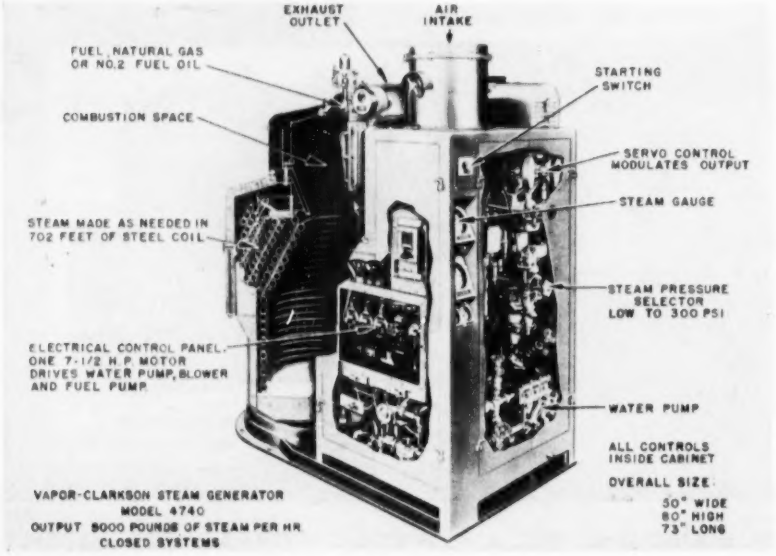
A new 1000-kw portable diesel generator set has been added to the Enterprise line. Recently shipped to the far east, the unit shown is one of several now in service at remote points.

Skid-mounted and shipped as a complete unit, it is ready to start generating power upon arrival. Fuel tanks, radiator, control panel and all other necessary gear are mounted on a common skid. Details are available from Department ES-6 Enterprise Engine and Machinery Co., San Francisco 10, California.

Overload Clutch

An overload release clutch which can easily be installed on sprocket, chain, belt and gear drives has been developed by the Overload Release Clutch Co., Inc. It is designed to allow machines to resume operation at the exact point of release. Detailed information is available from Dept E 1162 Stuyvesant Ave., Irvington, New Jersey.




EXHAUST OUTLET
AIR INTAKE
FUEL, NATURAL GAS OR NO.2 FUEL OIL
STARTING SWITCH
COMBUSTION SPACE
SERVO CONTROL MODULATES OUTPUT
STEAM GAUGE
STEAM MADE AS NEEDED IN 702 FEET OF STEEL COIL
STEAM PRESSURE SELECTOR LOW TO 300 PSI
ELECTRICAL CONTROL PANEL ONE 7-1/2 H.P. MOTOR DRIVES WATER PUMP, BLOWER AND FUEL PUMP
WATER PUMP
ALL CONTROLS INSIDE CABINET
OVERALL SIZE
50" WIDE
80" HIGH
73" LONG
VAPOR-CLARKSON STEAM GENERATOR
MODEL 4740
OUTPUT 5000 POUNDS OF STEAM PER HR
CLOSED SYSTEMS

Steam Generator

Vapor Heating Corporation has developed a steam generator that can change from fuel oil to natural gas fuel by flipping one switch and without interrupting steam output.

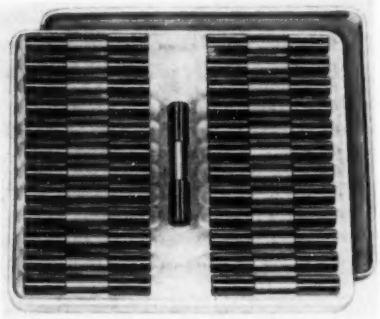
Called the Model OKJ-4740, it is designed to develop full working steam pressure up to 300 psi in less than three minutes from cold water, and produce 1500 to 5000 pounds of steam per hour.

The packaged unit weighs approximately 6000 lb and is 50 in wide, 80 in high and 73 in long. Detailed information is available from the company at 4501 West 16 Street, Chicago 23, Illinois.

PREVIEW

Nozzle Cleaning Kit

A new nozzle cleaning kit is now being made available by the American Bosch Corporation of Springfield, Massachusetts, to facilitate the cleaning of diesel engine spray nozzles in a safe and satisfactory manner. Developed primarily for those repair shops, fleet operators and others who have American Bosch or other nozzle test stands and undertake only a limited amount of service work, this kit is designed specifically for use with pintle-type nozzles and is available through all company distributors and service stations.

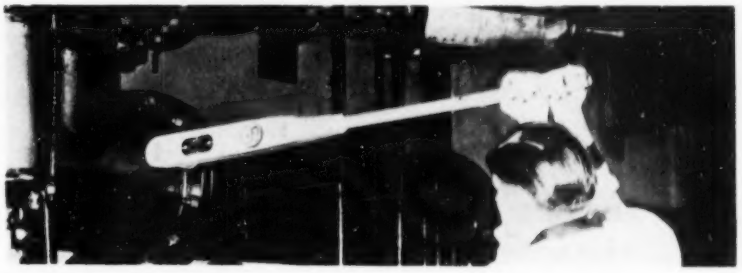


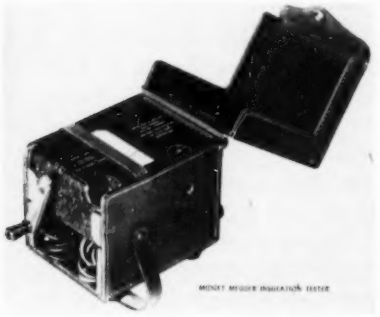
Plug Gauge Set

Designed to insure closer production tolerances and uniform inspection standards, the new plug gauge set is said to be entirely different type, according to the Deltronic Corporation. The set consists of a nominal size gauge with 12 larger and 12 smaller gauges, each varying in increments of .0001 in. Information as to size, ranges, etc. is available from the Deltronic Corporation, 9010 Bellanca Avenue, Los Angeles 45, California.

Torque Wrench

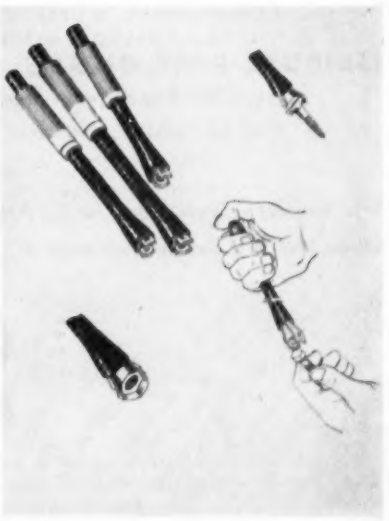
To accurately tighten nuts and bolts to any predetermined stress during the construction or servicing of equipment in plant, laboratory, or field, the Manzel Division of Frontier Industries, Inc. is now offering a torque wrench with a capacity ranging from 0 to 1000 ft lb and which incorporates some interesting features.





Tip Wrench

A new hand tool designed to hold nuts, bolts and screws and tighten or loosen them in hard-to-get-at places is now being manufactured by the Smith Heat Treating Company of 5865 Wilmington Avenue, Los Angeles 1, California. Made in three sizes, the unit is an adjustable socket pocket-wrench that is a combination wrench and screw driver.



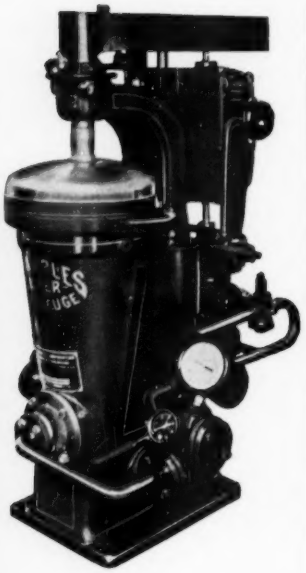
Insulation Tester

Called the Midget Megger Insulation Tester, this self-contained unit contains its own source of power in the form of a hand generator. Its chief applications include tests on motors, generators, rotary converters, transformers, power cables, etc., to mention a few. A compact unit, it is a handy tool for diagnosing faulty insulation before costly damage occurs.

Manufactured by the James G. Biddle Company, information is available from 1316 Arch Street, Philadelphia 7, Pennsylvania.

Sharples

CONTINUOUS CENTRIFUGAL OIL PURIFIERS



Pay Their Way

LUBRICATING OILS—Sharples Purifiers remove water, tank scale, carbon sludge and other impurities *without harming or removing protective additives.*

LIGHT FUEL OILS—Impurities such as dirt, tank scale and water are readily eliminated by Sharples Purifiers at low cost.

AIR FILTER OILS—Harmful corrosive and abrasive dust and moisture entrapped in filter oils, are removed continuously. Fresh make-up is held to a minimum.

RESIDUAL FUEL OILS—Sharples removes the unburnables from Bunker C and other residual oils—making these low cost oils a cheap, efficient diesel fuel.

Write Sharples—Headquarters for Oil Purification

Bulletin 1264 will be sent upon request

SHARPLES

THE SHARPLES CORPORATION • 2300 WESTMORELAND ST. • PHILA. 40, PENNA.
NEW YORK • PITTSBURGH • CLEVELAND • DETROIT • CHICAGO • NEW ORLEANS • SEATTLE • LOS ANGELES • SAN FRANCISCO • HOUSTON
Associated Companies and Representatives throughout the World

Two-Phase Balancing Motor

A new reversible two-phase motor having a rated speed of 333 rpm at no-load, has been introduced by the Industrial Div. of Minneapolis-Honeywell Regulator Co., Wayne & Windrim Aves., Philadelphia 44, Pa. Designed for use in the firm's line of instruments, the new motor can also be applied to other servomechanisms, remote-control devices and measuring instruments.

It is adapted for incorporation in apparatus requiring positive positioning, by means of a 60-cycle low-inertia drive motor capable of being operated from an electronic amplifier. When applied to recorders the motor provides necessary torque to drive pen carriage full scale in about 1.8 sec. It is designed for use in temperatures ranging from 20°F to 175°F, draws about 13.5 watts, and operates on a frequency of 115 v, 60 cycles.

Adhesive for Teflon

Flexrock Co., 3603P Filbert St., Philadelphia 1, Pa., is offering an adhesive for binding Teflon to itself or to metal and other materials. Of the pressure-sensitive type, the new adhesive has a peel strength of over a 1000 grams per in and a direct pull of 12 to 15 psi. It is said to have good acid and alkali resistance, excellent electrical properties and can be applied by brushing, dipping or spraying.

Nickel Alloys in RR Equipment

The International Nickel Co., Inc., 67 Wall St., New York 5, N. Y., is offering a new edition of its booklet on the use of nickel alloys in railroad applications. The presentation contains new illustrations and data on the use of alloys to meet requirements of improved design and modern methods of manufacture necessitated by the progress of the diesel-electric locomotive.

Power Lubricators

G & T Industries, Inc., Wichita, Kans., has developed two larger models of its Grease-Master. The new models do not require an air compressor or electricity to operate but are simply attached directly to the battery of a tractor, truck, or other vehicle to be

greased. A 6- or 12-v battery is said to work with equal efficiency.

Pressures are up to 12,000 lb and a pressure gauge and switch control pressure so that efficient lubrication of all types of bearings is assured. The new models are said to be particularly desirable where service trucks are used to lubricate equipment on the field.

DC Rectifier Welder

Metal and Thermit Corp., 100 E. 42 St., New York 17, N. Y., announces the availability of a new DC rectifier welder in 200-, 300-, and 400-amp ratings. The machine is a heavy-duty unit built for day-in and day-out service in production welding. Its design incorporates fan-forced, up-draft ventilation providing cool operating temperatures and assuring long rectifier life.

New Metallizing Machine

A metallizing machine incorporating a new nozzle and other improvements has been announced by Vandersee Engineering Co., Inc., 727 W. 7 St., Los Angeles, Cal. The new nozzle eliminates manual adjustments and assures even flow of metal.

All the bearings for the wire feed mechanism are encased in the main body gear case casting for perfect gear alignment, and thus can be easily repaired by semi-skilled workmen, on the spot. The gas-mixing chamber is now built in the nozzle at the point of combustion so as to completely eliminate backfire.

Water Conditioning Unit

A simple, low-cost water conditioning unit is being marketed by the EVIS Mfg. Co., 40 Boardman Pl., San Francisco, Cal., which is claimed to remove scale on metal and prevent its formation. The unit is said to cause a physical change in molecular behavior of water, enabling the water to penetrate and to loosen scale formations.

Scale is said to break away after a few weeks and to be carried off by the flow of water through the system. New scale is prevented because the scale-forming particles are held in a loose suspension and are not allowed

The fastest wrench you can put in the hands of a maintenance or production worker. Swiftly runs nuts or screws on or off—cuts costs—makes tough jobs easy. The Snap-on impact wrench delivers up to 2,000 powerful rotary blows a minute without twist or hammer shock to operator. Sets nuts solidly, or quickly reverses to break tough ones loose. ½" square drive takes sockets ⅜" to 1 1/16"—many accessory tools available. 2 models—115 volts, 220/230 volts. Available through Snap-on factory branch warehouses in principal industrial centers. Write for Snap-on Industrial catalog and new catalog of 4,000 hand and bench tools for production and service.

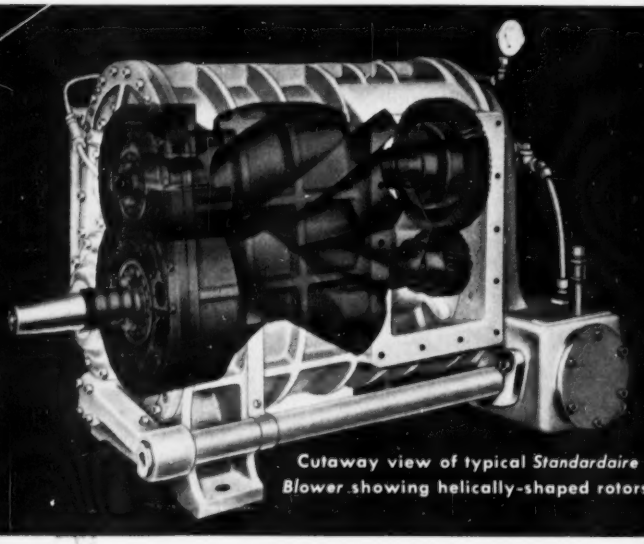
SNAP-ON TOOLS CORPORATION

8064-K 28th Ave., Kenosha, Wis.

*Snap-on is the trademark of Snap-on Tools Corporation.

Standardaire® Blowers

PUT A TIGHT SQUEEZE ON COMPRESSION COSTS



Cutaway view of typical *Standardaire Blower* showing helically-shaped rotors.

As the *Standardaire Blower's* unique helically-shaped rotors revolve, pockets are formed at the intake port which diminish in size as they approach the point of discharge. Within these pockets, air is compressed gradually and smoothly. The internal pressure is raised approximately to the discharge pressure before the pocket registers with the discharge port . . . reducing noise, shock, and loading of internal parts.

Since high pressure air is confined to the discharge end of the *Standardaire Blower*, leakage lines are much shorter than on other types of units. The rotors are accurately machined to very close running clearances and provide a continuous sealing for the entire length of their engagement. Their perimetral edges are sealed by the housing.

These are but a few of the unique features of *Standardaire Blowers* . . . which result in very high volumetric efficiency at lower installed cost, and lower maintenance and operating costs.

READ STANDARD
CORPORATION

BLOWER-STOKER DIVISION
370 LEXINGTON AVENUE, NEW YORK 17, N.Y.

to collect and harden. When the metal is clean and free of scale, a filmy white protective coating, about 0.003-in thick is found on all metal surfaces.

Reports say that pipes and jackets of diesel cooling water systems will remain clean. Engine exhaust temperatures are said to have dropped as much as 100°F after installation in open systems. Equally good reports have been received on closed system operations. The new development is said, in most cases, to separate gases found in water.

In the few years since the discovery of the principle, the company now claims nationwide and Canadian distribution. The EVIS is a complete, self-contained unit and once properly installed, is said to need no servicing; in fact, it is said to have improved action over increased periods of use. It will not change the chemical composition of water. Mr. Arthur N. Wells, inventor of the conditioner, states, "The EVIS is not a softener. However, it endows water with an entirely new set of colloidal properties." In standard units it is available in sizes from ½-in to 12-in, with larger sizes for special applications. It has a 90-day money back guarantee.

Swivel Air Connection

Now in quantity production by the Binks Mfg. Co., 3122 Carroll Ave., Chicago 12, Ill., is a compact, quick-detachable air connection said to provide almost complete free flow of air to air-powered tools and to hold pressure drop at the connection to only 5 per cent. Another advantage claimed is full 360-deg swivel action.

Precision Dynamometer

A precision dynamometer for measuring spring tension, starting torque, and the force required to actuate delicate mechanisms, is being produced by George Scherr Co., Inc., 200 Lafayette St., New York 12, N. Y. The instrument is available in two models, small and large, each in several ranges in grams of pressure. An illustrated pamphlet showing applications may be obtained from the company.

Brinnell Microscope Reader

The Pacific Transducer Corp., 11921 W. Pico Blvd., Los Angeles, Cal., an-

(*Continued on page* 70)

What Do You Know!

(Answers to questions on Page 38)

1. Most correct answer is "c". While compression ratios in the 8 or 9 to 1 range have shown best economy, many gasoline engines have been converted to burn LPG without increase in compression ratio. For a discussion see the article on Page 50.

2. Correct rating according to a two-year test by one bus operator is b-a-c. Granted that this is their first usage, they do not confirm the low maintenance costs predicted for LPG service. See article mentioned above for other comparisons.

3. "b" is correct answer. Properly engineered, there is little practical limitation to weights and sizes yielding to vibration control. For an example see article on Page 32.

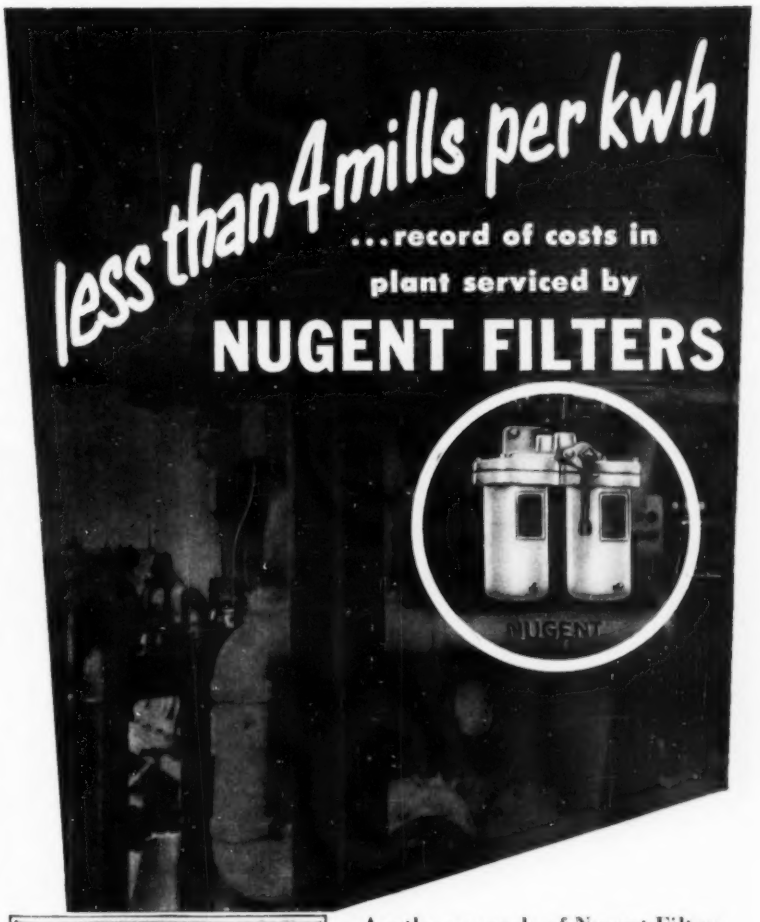
4. Correct answer is "b". This was the wear measured in one installation in which such liners were used. The operating conditions producing this figure are outlined in the article mentioned above.

5. Correct answer is "b". After sections are welded, dirt and foreign material is removed by forcing the pig through the pipe. For details of a complex pipe-laying job see Page 36.

6. "b" is correct. It has been found that part-load fuel consumption in dual-fuel engines can be improved by controlling excess air volume. For the arrangement on one make of engine, see article starting on Page 40.

7. Again, correct answer is "b". It is well accepted that the preliminary explosion in the crankcase, due to the unfavorable conditions for combustion, is of low intensity. For discussion of this, see the article on Page 54.

8. While still favored as an approach by some, "c" has been found to be the least practical solution. Difficulties of construction to insure adequate ventilation and air supply are problems. See the article mentioned above.



Nugent 1116SV Duplex Fuel filter of the type installed at the power plant in Teague, Texas.

Another example of Nugent Filters operating as members of an "efficiency team" is at this city-owned power plant in Teague, Texas. Here, a 960 HP Fairbanks-Morse dual-fuel engine equipped with a Nugent 1116SV Duplex Fuel Oil Filter turns out over 3,000,000 KW annually at a cost of less than .004 per KW hour.

Nugent fuel oil filtering of this type, by actual test, removes 99.8% of harmful impurities—particles as small as a few microns that might otherwise block the fuel injector or accelerate wear.

Whatever your filtering requirements—fuel, lube oil or coolants—there's always a Nugent filter available . . . at low cost . . . of proper size and type. Write for full details on how Nugent filters can improve the efficiency of your operations . . . why it is factory installed on so many leading diesel engines.

Wm. W. Nugent & Co., Inc.
417 N. Hermitage Ave. CHICAGO 22, ILLINOIS

OIL FILTERS, OILING AND FILTERING SYSTEMS, TELESCOPIC OILERS, OILING DEVICES, SIGHT FEED VALVES, FLOW INDICATORS

Established 1897

nounces a low-cost microscope reader for the measurement of the diameters of indentations made by ball indentors of all Brinnell-type hardness testing machines. The microscope can also be used to check the accuracy of the machines themselves.

The instrument features a reticle in a flat-field optical system and a self-enclosed beam of light. Scale is calibrated in millimeters and tenths of millimeters. Total scale length is 7.0 mm. Magnification is of 20 diam. The device may also be used to make other flat measurements within the 7.0-mm range and where medium magnification is required.

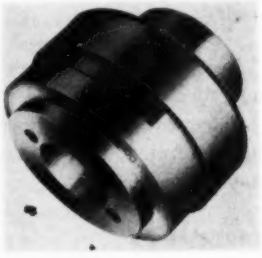
Magnetic Chip Retriever

General Scientific Equipment Co., 2700 W. Huntingdon St., Philadelphia 32, Pa., is producing a magnetic chip retriever to remove metallic particles from hard-to-reach places. Its single pole magnetic process is said to offer lifetime permanence.

The unit will remove chips from blind drill and top holes in both electrical and mechanical work. It may be used to test coat of surfaces for magnetic properties of the under material. It is about the size of a fountain pen and is mounted in a fiber non-conductive case with a pocket clip.

Direct-Mounting Coupling

A new modification of its standard Type C coupling, known as Type CIF, which is described as one which "crawls into the flywheel", has been introduced by the Lovejoy Flexible Coupling Co., 5051 W. Lake St., Chicago 44, Ill. It is designed for mounting directly to the flywheel of diesel and gasoline engines.



The modification consists of having one hub cut off and having three or more holes tapped in the remaining flange, by which the coupling is fastened to the center of the flywheel. Space of conventional hub-length is saved together with a cost savings in the elimination of the flange.

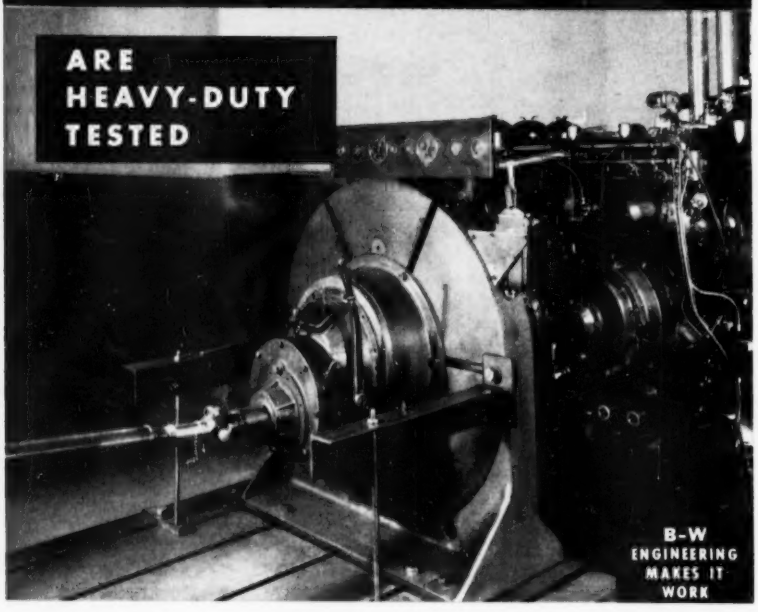
New Safety Solvent

Development of Turco-Solv, a quick-drying safety solvent designed for the in-place cleaning of hot main generators and traction motors was recently announced by Turco Products, Inc., 6135 S. Central Ave., Los Angeles 1, Cal. The solvent, said to have been developed in conjunction with several Class I railroads, was formulated with consideration of health hazards from toxicity as well as safety from flash fires.

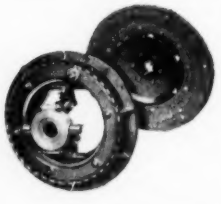
The compound may be used for cleaning of electrical equipment and is said to leave no oily residues, requiring no after-neutralization. It is non-corrosive and is claimed safe for use on all metal and wood surfaces as well as on well-bonded paint. It is applied by non-atomizing low pressure spray or brush.

ROCKFORD CLUTCHES

ARE HEAVY-DUTY TESTED



Large ROCKFORD Clutches, Power Take-Offs and Speed Reducers are tested for torque, engaging pressure, release, temperature, gear strength, bearing endurance and clutch facing wear on this 400 H.P. diesel powered, electric dynamometer. Let ROCKFORD engineers utilize this machine to improve *your* heavy-duty power transmission controls.



B-W PRODUCTION MAKES IT AVAILABLE

ROCKFORD CLUTCH DIVISION BORG-WARNER

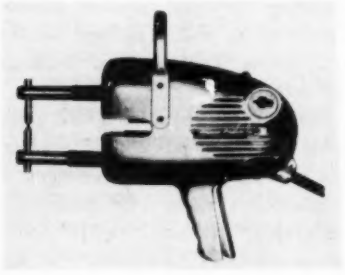
1301 Eighteenth Avenue, Rockford, Illinois, U. S. A.

Hydraulic Reservoir System

A package hydraulic reservoir system that includes storage tank, air vent breather, dip stick, splash baffle, and fluid strainer has been announced by Crenlo, Inc., Rochester, Minn., eliminating need for separate purchase and installation of breather, strainer and other components.

Time-Controlled Spot Welder

Ampower Products Co., 5737 W. 87 St., Oak Lawn, Ill., is producing a portable spot welder featuring an electronic timing control within the unit to take the guesswork out of spot welding. Its output is over 10 kva and it is said to weld most alloys of aluminum; and steel, mild and stainless and also galvanized and cadmium-plated.



The unit weighs 26 lb and has a pistol grip for easy operation and handling. A stand on which the welder can be mounted is available to convert it into a foot-operated floor model for semi-production work. For hard to reach places, a variety of specially shaped arms and tips are available. Timing control ranges from 1/60th of a second to a full second.

Fork-Lift Truck Attachment

Clark Equipment Co., Buchanan, Mich., announces development of an attachment that enables its standard 26,000-lb capacity Ross fork-lift truck to position a highway trailer on a flatcar in minutes. It was developed by invitation of EMD in conjunction with their rail-highway coordination program.

The fork truck is modified to allow speedy side-loading and unloading of trailers up to 35-ft long onto a specially designed railway car which will transport two trailers. Modification consists of a special short upright and a standard side-shifter with toed-in forks that support a pin which fits into a recess at the front end of the trailer. The truck was demonstrated to executives of American railroads at a meeting in LaGrange, Ill.

Young Utility Heaters

Young Radiator Co., Racine, Wis., announces a new line of utility heaters designed for mobile units and small space heating, for use with 35 psi hot water or 5 psi steam.

New Literature

Temperature Controls Catalog

The Burling Instrument Co., 5 Vose Ave., South Orange, N. J., announces publication of a new 4-page catalog which includes general descriptions of all its temperature controls, pictures of all models, and a separate description of its pneumatic and valve type controls. A selection and comparison table is also contained.

FILTERS MAY LOOK ALIKE

But ONLY Genuine

Luber-finer PACKS

Give the Results Enjoyed by MILLIONS OF SATISFIED USERS THE WORLD OVER

IT'S WHAT'S INSIDE THAT COUNTS

The Efficiency of LUBER-FINER'S Patented Process HAS NEVER BEEN EQUALLED!

DON'T BE MISLED BY PRICE ALONE!

There is NO substitute for DIESELPAK'S Patented Filtering Process for H. D. Compounded oils AT ANY PRICE. The DIESELPAK cleans more oil faster—keeps it CLEAN longer—and gives more service and better engineered protection than any other filtering element. It PAYS to get the BEST!

✓ PROTECTS ENGINE

The DIESELPAK is designed to remove not only ABRASIVES but also CONTAMINANTS such as moisture, carbon, acid, etc. from oil, and is engineered to keep the filtering media and the removed contaminants from migrating back into engine. The DIESELPAK assures continuous protection that reduces engine wear and maintenance costs far beyond that possible with other types of filter elements.

✓ EXTENDS PERIODS BETWEEN DRAINS

The DIESELPAK collects and holds even the most finely dispersed contaminants without affecting or removing compound additives from the oil. A glance at the dip stick will show that the oil is CLEANER—symbol of better lubrication and longer oil life enjoyed only by Luber-finer users.

✓ TAKES LESS OIL

The DIESELPAK because of its engineered construction requires 2 to 4 quarts less oil than spongy substitute filter elements being offered for use in the Luber-finer housing. This is an additional saving enjoyed when using the DIESELPAK.

STANDARD of the INDUSTRY SINCE 1936

Since Luber-finer was first introduced to the public in 1936, it has gained worldwide acceptance by millions of satisfied users everywhere. Luber-finers are approved by major oil companies and petroleum engineers. Luber-finers are standard or optional equipment on America's foremost stationary engines, diesel trucks, tractors and earth-moving machinery.

LUBER-FINER PACKS AVAILABLE:

1. REFINING PACK—Introduced to the public in 1936 for use with straight mineral oils, fuel oils and inhibited industrial oils.
2. DIESELPAK—First made available in 1941, the DIESELPAK was primarily designed for use with H. D. detergent compounded oils under the direction of Dr. Ulric B. Bray, B.S., Ph.D., F.A.I.C., internationally known Petroleum Chemist. The DIESELPAK has also achieved outstanding results when used with fuel oils and straight mineral oils.

GET THE FACTS FREE!

Why take chances with expensive equipment? WRITE TODAY for complete information on what to look for before you buy either Filters or Replacement Packs—see how you can save many dollars and hours in maintenance.

LUBER-FINER, INC., Dept. C, 2514 S. Grand Ave., Los Angeles 7

Diesel Liner Wall Thicknesses

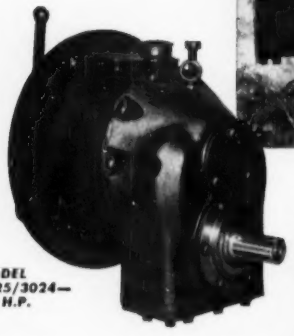
Available from the Office of Technical Services, U. S. Dept. of Commerce, Washington 25, D. C., is a report entitled "Ultrasonic Measurement of Wall Thickness in Diesel Liners", 19 pages long, containing photographs, diagrams and tables.

This is an account by scientists of the Naval Research Laboratory on better measuring techniques through the use of a new model of Sonigage. The instrument enables inspectors of foundry products to check and determine thicknesses of castings with increased accuracy and better visibility of the porous areas and core shifts.

Miehle-Dexter Superchargers

How its superchargers boost the power of engines is the subject of Bulletin 153, issued by the Miehle-Dexter Supercharger Div., Dexter Folder Co., 100 N. 4th St., Racine, Wis. A table and graphs are included in the folder for determining the proper size of unit to be used on various applications.

S-N REDUCTION GEARS



MODEL 2225/3024—40 H.P.

SPECIFIED AS ORIGINAL EQUIPMENT ON HIGHLY MOBILE DIXIE CRANES

Designed for high speed operations that require a mobile unit, these three-eighths yard bucket Dixie Cranes — made by the Freshwater-Smith Machine Company, Ft. Pierce, Florida — are equipped with S-N Heavy Duty Herringbone Reduction Gears as original equipment in order to insure **maximum versatility** and the **smooth transmission** of **full power** from engine to load — smoothly — and at a minimum cost.

These rugged, compact S-N Reduction Gears are built for grueling, continuous operations with all types of engines from 40 H. P. units to 775 H. P. giants! They can be installed as original equipment or for repowering of pumps, shovels, generators, compressors and all types of dredging and ditching equipment. Available in a broad range of reduction ratios — of 1.5:1 up to 4:1. Our engineers will be glad to specify the best unit for maximum performance on your equipment. Write today for detailed catalog sheets. Address Industrial Division.

SNOW-NABSTEDT

Transmission Engineers

FOR NEARLY HALF A CENTURY

THE SNOW-NABSTEDT GEAR CORP., HAMDEN, CONN

Nordberg TS-21 Diesels

New improvements of its Type TS-21 diesel engines are discussed in a 2-color bulletin, 224A, published by Nordberg Mfg. Co., Milwaukee 1, Wis. Ranging in size from 2550 hp, 1800 kw to 6150 hp, 4400 kw, the engines are most widely used in municipal power plants, central stations, and industrial power plants. Installation photographs illustrate these applications.

Of special interest to stationary power users is the cross-sectional drawing through the power cylinder, showing the features and design improvements in the engine.

Heat Transfer Products

Young Radiator Co., Racine, Wis., has released a 4-page, 2 color catalog featuring its heat transfer products for chemical, industrial and oil field applications. Each unit is illustrated and described.

Included in the catalog are engine jacket water coolers, "CC" combination cooling units, supercharger air intercoolers, evaporative coolers and condensers, "HC" and "VAD" coolers and condensers, shell-and-tube heat exchangers, heating and cooling coils, unit oil coolers, and steam condensers.

Alco Products Review

The fall, 1953 issue of "Alco Products Review" has been released by the American Locomotive Co., Schenectady 5, N. Y. It contains material of interest to engineers in the chemical, petroleum and power fields. The new issue features an article on air-cooled heat exchangers: types, applications, design considerations, economic factors in selection, and typical installations.

New Worthington Magazine

Worthington Corp., Harrison, N. J., announces release of the first issue of "Power and Fluids", its new technical publication. The magazine will be issued quarterly and will describe new product applications, processes, and methods. Subjects will include installations and operation and maintenance of industrial apparatus, with all material slanted to serve as technical aids.

Beryllium and its Alloys

The Beryllium Corp., Reading, Pa., has issued a 20-page booklet describing its beryllium products, including the pure metal, oxide, and alloys.

In most applications, beryllium is alloyed with other metals to enhance their mechanical properties. The most widely used alloy is beryllium copper containing 2 per cent beryllium which can be heat treated from a soft workable metal to high levels of hardness. The product directory presents in concise form the various commercial products offered by the company including copper wrought products, casting ingots, castings, nonsparking tools, forgings.

Industrial Inferential Meter

Simplex Valve & Meter Co., 68th and Upland Sts., Philadelphia 42, Pa., has prepared a 16-page bulletin describing its Type MO meter, an instrument for the measurement of fluid flows. Contained in the 16-page bulletin are data on operation, construction, accuracy, primary devices and other general information of interest to power, process and sanitation engineers who deal with fluid flow problems.

Railroad Folder

"Electric Power for Railroad Jobs Anywhere" is a new 4-page folder issued by D. W. Onan & Sons, Inc., Minneapolis 14, Minn. Described and illustrated are the entire range of the company's electric generating plants as they are used by the railroads, along with general specifications.

ASTM Standards on Copper

The American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa., is making available its latest edition of standards pertaining to copper and copper alloys. The 1953 edition includes 102 specifications, 9 test methods, 2 recommended practices, and 2 classifications.

Standards cover copper, copper alloy, and copper-covered steel electrical conductors; non-ferrous metals; plate, sheet, strip, and rolled bar; rod, bar, and shapes; wire; pipe and tube; ingot; sand and die castings; filler metal; and methods of test.

Diesel Engine Applications

"The Power Parade", recently issued by Caterpillar Tractor Co., Peoria 8, Ill., covers 28 applications for the 12 different sizes of the company's diesel engines.

Machine Tool Attachments

South Bend Lathe, South Bend 22, Ind., has collected into one large bulletin the complete story on its many machine tool attachments and accessories, giving a bird's eye view of the job ranges possible with the equipment. Request Catalog 5321C.

Tubing For Diesel Trucks

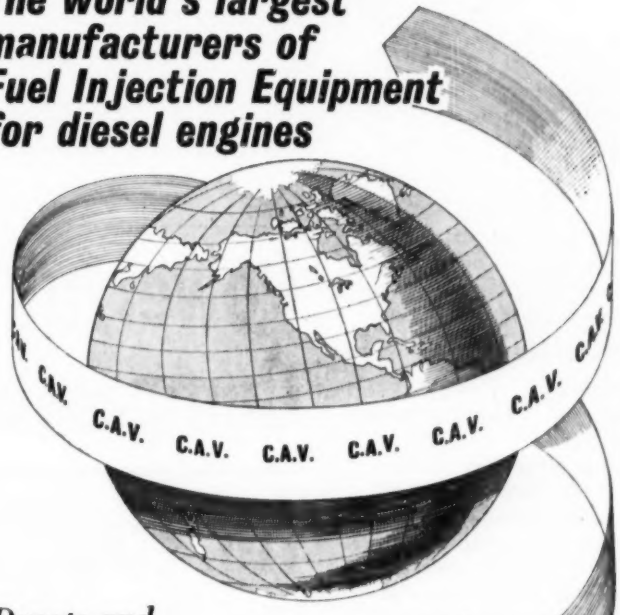
A new bulletin on RT-8 heavy duty automotive tubing for the diesel trucking industry has been issued by Flexonics Corp., Maywood, Ill. The tubing is said to be particularly well adapted to tough heavy duty operating conditions and applications where corrosion may quickly deteriorate lighter gauge tubing.

Occupational Safety Guide

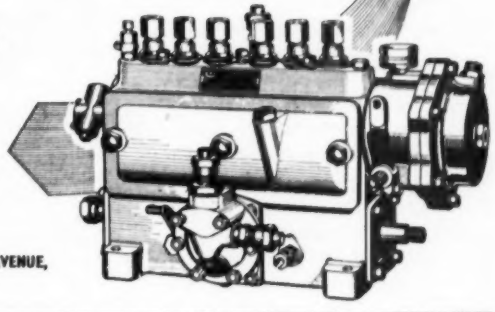
The National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill., has issued a new "Occupational Safety

C.A.V.

The world's largest manufacturers of Fuel Injection Equipment for diesel engines



Depots and Service Agents in over 100 countries



C.A.V. DIVISION OF LUCAS ELECTRICAL SERVICES INC.,
653, TENTH AVENUE,
NEW YORK 19, N.Y.
Sales Office: 14820 DETROIT AVENUE, CLEVELAND 7, OHIO.

C.A.V. Fuel Injection and Electrical Equipment

174-606

How much of your engine maintenance bill is due to repair of breakdowns that could have been avoided—*if you'd had advance warning?*

At a fraction of that cost, Alnor Exhaust Pyrometers offer you a constant check of engine performance—advance warning of

Cylinder Overload **Preignition**
Scaled Jackets **Clogged Ports**
Detonation **Faulty Injection**

Get the best from your diesel—minimum fuel consumption per horsepower and long service uninterrupted by foreseeable breakdowns. Get constant protection of your engine, cylinder by cylinder, with an Alnor engineered Exhaust Pyrometer System.

Get Full information—Quickly! Your nearby Alnor Diesel specialist is conveniently listed in the classified directory. Ask him to help you select the Pyrometer and thermocouple assembly designed for your engine. Or send for Bulletin 4361 with complete details of the full Alnor line of Pyrometers.

ILLINOIS TESTING LABORATORIES, INC.
Room 507, 420 N. La Salle St., Chicago 10, Illinois

Service Guide" designed to provide a complete catalog of the many accident prevention aids available from the Council.

The guide not only lists tools needed to build plant safety programs but also training aids available for instruction of workers. A complete library of technical and administrative publications is listed, covering all phases of accident prevention. Posters, films, and booklets are also offered.

Training in Industry

South Bend Lathe, South Bend 22, Ind., has issued a folder describing all of its instructor-student aids. Bulletin 5329 covers the standard books on machine shop operations, charts, and films available from the company.

Expansion Joint Bulletin

Flexonics Corp., 1315 S. 3rd Ave., Maywood, Ill., has released an 8-page illustrated bulletin describing its line of expansion joints. Basic data necessary to the proper selection and application of pipeline expansion joints are presented, including a discussion of types of pipeline motion frequently encountered and methods of handling this motion. An important section deals with the proper guiding and anchoring of expansion joint installations.

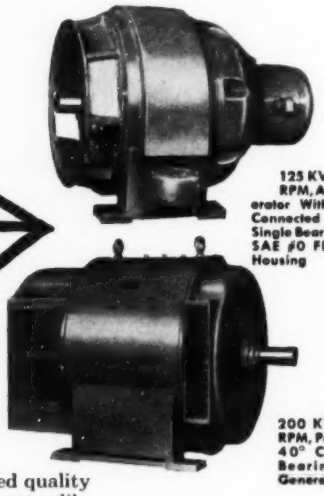
Storage and Handling of LPG

The engineering department of the National Board of Fire Underwriters, 85 John St., New York 38, N. Y., is making available pamphlet No. 58, which sets important standards for the storage and handling of liquefied petroleum gases as recommended by the National Fire Protection Assn.

Electrical Control Components

A comprehensive catalog on electrical control components for industrial use is being offered by Automatic Electric Co., 1033 W. Van Buren St., Chicago 7, Ill. Illustrated by photographs and diagrams, the catalog contains specifications and data on key switches, impulsing devices, switchboard lamps, jacks and caps, and other control devices.

Powerful Companions for Your Engines



125 KVA, 1200 RPM, A.C. Generator With Direct Connected Exciter, Single Bearing With SAE #0 Flywheel Housing

200 KW, 900 RPM, Protected 40° C, Two Bearing D.C. Generator

● For over 25 years Columbia has furnished quality built generators for engine drive. They're sturdily built with materials of the highest quality to provide dependable power.
Your needs can be supplied promptly, whether your requirements are for single bearing generators with or without adaptor for SAE flywheel housing, or for units with two bracket bearing design. A.C. ratings 6.25 to 1000 KVA, D.C. ratings 2 to 300 KW. Our engineers will be glad to review your requirements.

COLUMBIA

A.C. AND D.C. GENERATORS

Write Today for Bulletins 600 and 800

COLUMBIA ELECTRIC MFG. CO.
4537 HAMILTON AVE · CLEVELAND 14, OHIO

Electric Controls Catalog

Lake Shore Electric, Inc., 211 Willis St., Bedford, Ohio, has published a catalog describing the various types of controls it manufactures for industrial, marine, military and power plant applications. The company's complete engineering, design and fabrication facilities are outlined and pictured.

Accident Rates in Industry

The National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill., is making available its 1953 series of "Accident Rates" booklets for each of 22 groups of industries. The booklets contain the 1952 accident experiences of all companies that report to the Council.

Liquid Level Gauges

Jerguson Gage & Valve Co., 80 Fellsway, Somerville 45, Mass., has issued a set of new data units—nine sheets covering the company's complete line of liquid level gauge valves for both tubular and flat gauges, regular offset, and with union connections. Specifications are complete with illustrations showing cross-sections, roughing dimensions, standard and optional connections available.

Liquid-Level Control

A single-thyratron electronic liquid-level control, operating without radio frequency from a single capacitative type probe, is described in a folder issued by Thermo Instruments Co., 1166 El Camino Real, Belmont, Cal. The publication illustrates the single-unit control, the probe and alternative schematic arrangements, for installation in various fields. Specifications are included.

Aero-Thread Stud Drivers

Heli-Coil Corp., 1363 Shelter Rock Lane, Danbury, Conn., announces the availability of a new 2-page, 2-color bulletin on its line of areo-thread stud drivers. Photographs illustrate the tools and their components. Tables provide specification data for hand or power models.

DIESEL USERS AGREE

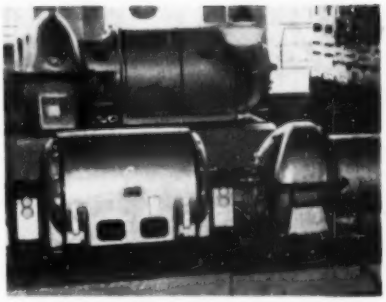
that for Completely Dependable Automatic Lubrication, it's

Manzel

FORCE FEED LUBRICATORS

Manzel

DIVISION OF FRONTIER INDUSTRIES
271 BABCOCK STREET, BUFFALO 10, N. Y.



Give your equipment that NEW LOOK

SPRUCE up your diesels, generators, other heavy equipment by giving them a quick rub-down with Oakite Renovator.

Oakite Renovator, solvent-emulsion type cleaner, is easy to apply by cloth or sponge. Goes after grime, oil, soot, other surface dirt in a hurry. No rinse necessary — just polish with a dry-cloth to bring out high paint luster. Completely safe on painted surfaces, Oakite Renovator presents no fire hazard because its solutions are water-mixed.

Ask your local Oakite Technical Service Representative for free on-the-spot demonstration. Or write for new "Power Plant Cleaning" Booklet. FREE!

OAKITE PRODUCTS, INC.
22C Rector St., New York 6, N. Y.

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS • METHODS • SERVICE

Technical Service Representatives Located in Principal Cities of United States and Canada

Field Notes

Diesels Aid Locust Elimination in Africa

Halting a disastrous red locust plague before it gets started is the big job handled by the International Red Locust Control Service in Central Africa. Headquarters of the I.R.L.C.S. is in Abercorn, Northern Rhodesia, located at the southern tip of Lake Tanganyika. The organization is a joint group sponsored and paid for by the governments of most of the territories and countries of Central and Southern Africa.

Tractors are used to haul insecticide-spraying equipment, mounted on trailers, through the swampy locust breeding areas. The group first used wheel tractors exclusively, but these couldn't negotiate in some of the difficult, boggy, swampy areas.

Two years ago, the I.L.R.C.S. introduced a Caterpillar D2 track-type tractor in this operation and it has been working constantly in the most difficult areas. It has since purchased two more D2s.

These tractors are forced to operate in water and muck for almost a third of the time they are in actual use. By using these American-made track-type tractors, it has been possible, according to members of these field parties, to get in and destroy threatening swarms of locusts that otherwise would be breeding endlessly.

Machine Tool Forecast

According to the National Machine Tool Builders' Assn., the nation's machine tool production by the end of this year will be approximately the same as that for 1952. Actual shipments, however, may be a little larger due to completion in 1953 of national defense machines on which production was started in 1952. The first nine months of 1953 saw shipments 11.1 per cent above the same period of 1952, while new orders were 16.8 per cent below 1952.

The sharp decline in new orders for defense purposes is said to have been offset to a large extent by the increase in orders for machine tools for civilian purposes. At September's end, backlog for the industry as a whole stood at seven months production at present capacity, the lowest backlog since before the Korean war. Backlog reached 23 months at the height of the Korean emergency and now has come down to where normal deliveries on most types of machine tools can be obtained.

The sustained volume of new orders which has followed defense production slowdowns and cancellations is claimed as evidence of a growing awareness of the need for modern machine tools to reduce costs in the highly competitive business phase developed since the end of the Korean war.

Railway Diesel Progress

The dieselization of American railroads is progressing at a fast clip, according to the Association of American Railroads. Except for two or three roads whose main business is the transportation of coal, the association explains, nearly all long-distance freight and passenger trains in the United States are now diesel-powered.

Out of 89 Class I passenger-carrying railroads up to April of this year, 68 were dieselized 70 per cent or more, 63 dieselized 80 per cent or more, 57 dieselized 90 per cent or more, and 28 were dieselized 100 per cent.

Out of 120 Class I freight-carrying roads as of April of this year, service of 98 was dieselized 70 per cent or more, 86 were dieselized 80 per cent or more, 78 dieselized 90 per cent or more, and 52 were dieselized 100 per cent.

In May 1953, diesel-electric locomotives performed 78.4 per cent of the passenger train service, 74.5 per cent of freight train service, and 82.6 per cent of the switching service.

Lab Tests For Soils Corrosion

A recent study by the National Bureau of Standards reveals that reliable data on the corrosion of ferrous metals in soils of various types can now be obtained in the laboratory in a period of six months. Ten or more years are usually required for field testing.

Corrosion was produced in small laboratory cells by differential aeration of metal disks in contact with soil within the cells. Results showed

good correlation with corrosion observed on specimens in long-term exposure tests and should thus provide a valuable basis for predicting service of iron and steel structures exposed to soils.

The Bureau states that although measurements with the laboratory cell would not be considered to entirely replace field exposure tests, it is unlikely that materials which corrode at the same rate in the laboratory would corrode at significantly different rates in the field. It was found that the cell could detect important differences between the corrosion rates of cast iron and steel which are generally considered to corrode at about the same rate in soils. The cell might therefore be used to study effects of variables, including composition, upon corrosion rates of steels. It is also reasonable to expect that the cell could be used to predict corrosion in soils of nonferrous metals such as copper, brasses, lead, zinc, and possibly aluminum.

GM Shotblasting Research

Reporting before a committee of the SAE, Raymond L. Mattson and W. S. Coleman, Jr. Engineering Mechanics Dept., General Motors Research Laboratories, explained that although industries in the past few years have adopted shot-peening (or blasting) and other "cold working" methods to increase fatigue life of parts, certain variables about these techniques are still largely unexplored.

Their report centered around a series of laboratory tests involving more than 100 groups of four automotive leaf spring specimens. These, they said, were heat-treated, cold-worked, and tested. Approximately 50 of them were dissected and analyzed for residual stresses. The research team posted these general conclusions with respect to shot-peening specimens of this type:

1. It appears that there is a minimum shot velocity for each shot size to obtain best fatigue life. Greater values do not add to fatigue durability, thus are wasteful and costly. Minimum value is considerably lower than that normally used.

2. Unless exposure time is up to some minimum value, best fatigue life is not obtained. An excessive value produces no significant fatigue life increase and hence is wasteful and costly.

3. Influence of shot size on fatigue life is not particularly great over a full range of air pressures and exposure times.

4. For these specimens, fatigue life was increased by 20 times over non-peened specimens.

5. By shot-peening specimens while under tensile strength, fatigue life was increased by as much as 200 times over non-peened specimens and 10 times over strain-free shot-peening. Greatest benefits derived under strains greater than 80 per cent of yield strength.

6. Shot-peening introduces residual compressive stresses of the order of 50 per cent of the material yield strength, regardless of shot size and velocity. Depth of compressed layer increases with both shot size and vel-

ELIMINATE

costly repairs on your engines

PENN Safety Controls prevent little troubles in engine lubricating and cooling systems from growing into major engine breakdowns with their attendant costly repairs. Here's how it's done . . .

If water temperature rises too high or if oil pressure drops too low . . . the PENN Safety Control swings into action. Automatically it sounds an alarm, flashes a warning light or stops engine operation . . . whichever you choose. Then, the fault can be investigated and corrected before serious damage develops.

Learn more about this low-cost protection for your engines. Write **Penn Controls, Inc., Goshen, Indiana.** Export Division: 13 E. 40th Street, New York 16, N. Y., U.S.A. In Canada: Penn Controls Limited, Toronto, Ontario.

PENN

AUTOMATIC CONTROLS

FOR HEATING, REFRIGERATION, AIR CONDITIONING, GAS APPLIANCES, PUMPS, AIR COMPRESSORS, ENGINES

ocity, ranging between 0.006 and 0.026 for treatments used.

7. Residual compressive stress considerably greater than 50 per cent of yield point can be introduced by shot-peening while surface is under tensile strain.

8. Although data are limited, magnitude of residual compressive stress appears to be reduced by fatigue testing.

9. There is direct correlation between magnitude of compressive stress near the surface and fatigue life of the specimens.

Germans to Make GM Trains

Shown below is Oscar R. Henschel of Henschel & Sohn, Kassel, Germany, in the act of signing an agreement with N. C. Dezendorf, vice president of General Motors Corp. and general manager of the Electro-Motive Div., for the manufacture of GM diesel locomotives in Germany.

The following statement was issued by Mr. Dezendorf:

"The agreement provides for collaboration in the design, manufacture and marketing of diesel locomotives of standard types to be evolved, based on Electro-Motive's long experience in the motive power field. The locomotives will be manufactured by Henschel in their Kassel plant, utilizing designs

and manufacturing methods which have proven so successful in the production of locomotives for United States railroads. Local manufacture of important components of the locomotives will be fostered under the agreement. The agreement will encourage the even wider use of the General Motors 567 series diesel engine around the world, particularly in road locomotives."

Twenty thousand diesel road locomotives (switchers not included) are estimated by Mr. Dezendorf to be in operation throughout the world. It was stated that 12,000 of these are powered by the GM 567.

Henschel and Sohn was founded 150 years ago and was the largest locomotive plant in the world in the prewar era, according to Mr. Dezendorf. The company also manufactures diesel engines, heavy trucks and buses. The agreement follows the lines of previous agreements signed by GM with locomotive builders of Australia, Belgium, and Sweden.

Diesel Goes To Virgin Islands

Now being erected to serve the entire island of St. Thomas in the Virgin Islands of the United States is a generator set powered by an Enterprise DSQ-318 diesel engine. The unit, rated at 1765 bhp, will generate 1240 kw. Other existing equipment will remain there for occasional peak-loads.

The HEART of a diesel lubricating system is its PUMP

Rotary geared pump with special flange mounting becomes integral part of diesel engine when installed. Note opening above relief valve for tachometer.

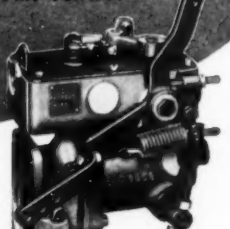
Modern diesel operation generally requires a pressure lubricating system — and the vital element is the pump. Thousands of Brown & Sharpe pumps are now providing reliable service month after month without interruption, for lubrication, transfer, or booster systems. Available with various types of flange mountings and special internal construction to meet specific requirements. Write for catalog. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

We urge buying through the Distributor

BROWN & SHARPE BS

PIERCE

CENTRIFUGAL governors give you exact R. P. M. control . . . at LOWER COST



For more than 40 years Pierce has specialized in the speed control field. Pierce *Centrifugal* Governors, engineered specifically for your Diesels, give accurate, dependable control of engine RPM to meet the varying conditions of any job. Pierce Governors are standard equipment on many of America's finest diesel engines . . . assuring maximum protection, dependable performance—at lower initial and maintenance cost. Replacement governors and parts are available through your local distributor or fuel injection service station.

For distributor's name or information on special governing problems, write

PIERCE

the PIERCE GOVERNOR CO., Inc.

1614 Ohio Avenue, Anderson, Indiana

"WORLD'S MOST EXPERIENCED GOVERNOR MANUFACTURER"

Crankcase Explosions

(*Continued from page 56*)

the power input to the nichrome element was increased until an explosion occurred. An input of 5.7 kw to the nichrome element was required for the explosion.

Recorded pressures indicated that the intensity of the explosion had not exceeded 20 psig. The only external evidence of the explosion was smoke and oil ejected from around the crankshaft labyrinth seal. After sufficient time elapsed, inspection of the engine failed to disclose any damage, loose covers, capscrews, etc. It was found that only the water in the crankcase suction manometer had been blown out.

In order to determine the effect that lube oil temperature has on intensity of explosions, a series of four test explosions were consecutively induced without an engine shut-down between the explosions. For each of these explosions, the power input to the "hot spot" was held constant at 5.7 kw. Although the lube oil temperature varied from 160°F to 230°F, all explosions occurred from 13 to 15 sec after the "hot spot" was energized and pressures held consistently between 10 and 20 psi. Tabulated results are shown in Fig. 9.

In reviewing the tabulated results, it will be noted that in test Nos. 4 and 5 the engine horsepower was increased from 1060 to 1340 and 1740, respectively. This was necessary to obtain oil temperatures above 200°F.

The only ruptured fuses in the diaphragm-type pick-up circuit were those connected to elements set at 5 to 10 psi. Fuses connected to elements set at 20, 30, 40 and 50 psi did not rupture in any of the tests. The paper mounted on the drum of an indicator worked loose in test Nos. 2 and 4 and no data was obtained.

During an accelerated test when the engine was equipped with special experimental pistons and was being operated at 95.5 bmep, 850 rpm, with 270°F lube oil temperature, one of the pistons seized and a crankcase explosion occurred. However, all covers remained tight and there was no explosion damage to the engine.

Conclusions

The following conclusions have been drawn from the test work described herein.

1. With all engine conditions normal except for a "hot spot" in the crankcase, peak pressure developed by a primary explosion will not exceed 20 psig.

2. Varying the oil temperatures from 160°F to 230°F has no important effect on maximum explosion pressures developed. Also, an explosion with 270°F lube oil temperature did not result in any explosion damage.

Fairbanks, Morse & Co. has incorporated this explosion-proof design in approximately 200 engines now operating in railroad service. Even though several of these units have had internal part failures which ignited crankcase vapors, not one has had a cover blown off or suffered any explosion damage. This combination of service experience and experimentation has demonstrated that "crankcase explosions can be contained".

Wherever your diesel operates . . . FRAM lube and fuel oil filters are your best assurance of *dependable* power year after year.

FRAM Filters guard your engine against power robbing sludge, dirt and dust . . . filter out harmful particles as small as .000039".

A FRAM lube filter cleans oil faster, cleaner and keeps it clean longer than any ordinary filter. Bearings, liners, rings and other vital engine parts wear longer . . . reducing costly down-time and maintenance.

FRAM fuel filters keep your diesels operating at top efficiency with clean, even fuel injection . . . protect precision fuel injectors against abrasion and excessive wear.

Thousands of FRAM installations have proved that superior FRAM protection pays for itself in lower operating costs, increased time between overhauls and less oil consumption.

FRAM Filcron
THE MODERN OIL FILTER

Solve your filtering problem with FRAM

Whether your filter problem is lube or fuel, FRAM Filters offer you the most efficient and profitable solution. Let FRAM engineers prove it . . . write today to: FRAM CORPORATION, Providence 16, R.I. *In Canada:* Fram Canada Ltd., Stratford, Ontario.

(*Continued from page 78*)

Crude Oil Recovered By Fire

A new method of heavy crude oil recovery has been developed after six years of study by a group of scientists and engineers at the Magnolia Petroleum Co.'s research laboratory in Dallas, Tex. The new method, a joint project of Socony-Vacuum and its affiliates, Magnolia and the General Petroleum Corp., may lead to recovery of part of America's vast "unrecoverable heavy crude oils".

Research scientists Carl S. Kuhn and Robert L. Koch, who led the experimental work, call the system "oil recovery by in-situ (Latin meaning: in place) combustion", a process of producing heavy viscous crude oils by thinning or melting them with underground fire.

In the United States alone it is estimated that there are probably more than four billion barrels of oil in the ground labeled "unrecoverable". These crudes, because of their low viscosity, cling to oil sands and will not flow into oil wells. Until now nobody has been able to get more than a fraction of them out of the ground. In-situ combustion seems to provide the first step toward the answer.

In the same way that heat applied to butter melts it into a more fluid state, the scientists theorized that if the crudes could be heated and made fluid, they could be forced to flow through the sands into producing wells and be recovered. It was decided that actually setting fire to part of the oil in the ground would thin the oil.

Packing heavy-crude-and-salt-water-soaked sands into tubes, they pumped in air and set the heavy oil on fire. The fire thinned the crude, while the air pressure pushed the thinned oil out the far end. They recovered over 60 per cent, sometimes as high as 90 per cent, of the original oil-in-place. Something less than 15 per cent was actually consumed by fire. The next step was to try an actual oil field. They located one in Oklahoma.

On July 22, 1952, the men ignited the underground oil in one of the wells. Fifty days later, the fire burned into the next well, 20 ft away, proving that oil could be burned underground in its natural state. Today, the researchers are working on a new test in the Oklahoma field. With five wells grouped together, they will start the fire in the center well, which will give more information about how the method works and more accurate cost data. Target date for finishing this test is June, 1954.

Canada Firm Expands into U. S.

Kingsway Transports Ltd., Canada Steamship Lines subsidiary, has recently acquired Colossal Lines Ltd., New York, in a move to extend its trucking operations south of the border. The company purchased the U. S. firm to obtain a franchise into the northern industrial area of the United States as well as to gain a substantial fleet of heavy diesel trucks.

Reveal RR-Truck Freight Plan

A plan to bring long-distance truck companies and railroads together in

"AMOT" THERMOSTAT

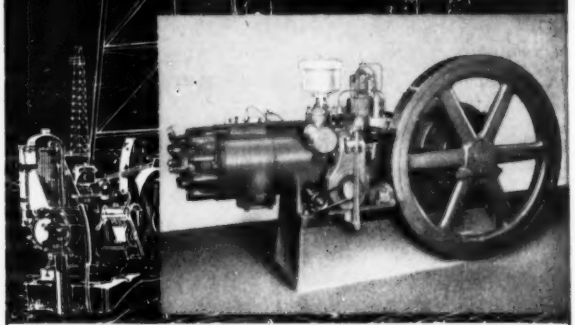
"Performance without trouble" is the reason more engine manufacturers, pipe lines, power plants, oil companies and shipyards are using AMOT as standard for automatic engine water and oil temperature control. AMOT thermostats offer the following advantages:

1. Large capacity combined with light weight.
2. Excellent reliability even under extreme shocks and vibration.
3. No external bulbs or tubing to break and cause trouble.
4. Temperature is fixed and cannot be tampered with by operator.
5. Holds close regulation and is not sensitive to pressure.
6. Operating forces are very large and with no packing glands there is no chance of valve ever sticking or becoming inoperative.
7. Because of its simple and rugged construction, practically no maintenance is ever required.
8. Has positive 3-way valve action in which full pump capacity flows through the engine at all times.
9. Compact in size and will operate in any position, which facilitates piping.
10. Available in pipe sizes up to 6" for all types of gas and diesel engines.

Write for catalog and name of your nearest AMOT representative.

AMERICAN MOTORS CO.
RICHMOND CALIFORNIA

For low-cost power rely on
LORAIN Multi-Fuel ENGINES



55 HP Lorain Model DA with gasoline starter

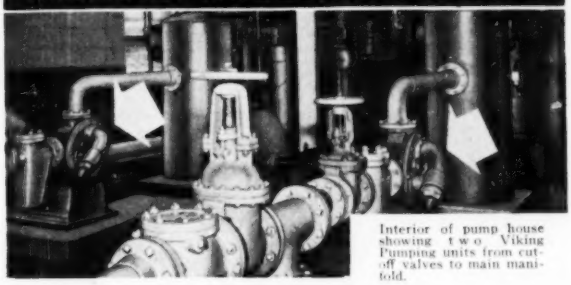
. . . full line from 10 to 55 HP

Lorain diesel or gas engines are built with an extra margin of stamina to stand up to gruelling service. Simple 2-cycle, single-cylinder design reduces moving parts for dependability. They operate as cold-starting diesels or can be converted easily and quickly in the field for natural gas or butane.

Get full details on Lorain Multi-Fuel Engines. *They operate longer without attention . . . operate longer between overhauls.* Write for specifications today. A-5973

WHITE-ROTH *Machine Corp.* **LORAIN, OHIO**

Central of Georgia Saves With
VIKING FUELING PUMPS



Interior of pump house showing two Viking Pumping units from cut-off valves to main manifold.

Better fueling operations and saving of expense results from the diesel-fueling installation designed by The Central of Georgia Railway at Columbus, Georgia. Pumping, storage and transfer facilities are concentrated at a central location, yet fuel oil is delivered to three widely separated stations by two 300 gpm Viking Pumps, automatically controlled by pressure switches.

If you have a liquid-moving problem, no doubt Viking Pump engineers can help you solve it. To start, write for bulletin 803D.

VIKING AN HONORED NAME IN PUMPING

See Our Catalog in Sweet's

VIKING PUMP COMPANY
CEDAR FALLS, IOWA

KIENE®

MODEL K-120 UNIVERSAL
PEAK PRESSURE INDICATOR

For Testing Firing and Compression Pressures on all Models of Diesel and Gas Engines. Dependable — Rugged. May be Used With or Without Flexible Tube.

MODEL K-120 Indicator has but one moving part — nothing to wear or get out of adjustment.

VALVE — Gas trap type with diaphragm type check valve having adjustable lift. Stainless steel valve and seat.

No springs — No pistons — no complicated adjustments — No temperature corrections — no pressure loss in check valve.

GAGE READS TRUE PRESSURE — MAY BE RECALIBRATED ON ANY GAGE TESTER

Check readings can be made over and over again by releasing indicated pressures with bleeder valve.

ADAPTORS available for most models of engines manufactured in U. S. A. Other models made to order at reasonable prices.

KIENE DIESEL ACCESSORIES, INC.
10352 PACIFIC AVE., FRANKLIN PARK, ILLINOIS

a new type of coordinated freight service to take many large semi-truck trailers off roads and put them on rails was disclosed recently in a demonstration of the program at the Electro-Motive Div. of General Motors. It is intended to benefit the public by reducing traffic loads on main highways and to speed delivery of freight; to restore freight revenues to railroads; and to improve the motor carriers' financial position, many of whom are finding it difficult to make ends meet under present conditions.

Under the plan, motor carriers will pick up cargoes at shippers' docks or assemble trailer loads in their own terminals, and then deliver the loaded trailers to a rail loading dock at the edge of a city. Here, special loading devices will load the trailers on special trailer transport cars, each carrying two loaded trailers. (A special 75-ft long car designed by EMD was demonstrated.) At the destination city, cars will be unloaded at a special terminal at the edge of a town and the motor carriers' own tractors will pick up the trailers and deliver them.

"It is believed such a system will enable the railroad to operate the service profitably and to charge a low enough rate to attract the available motor carrier business in volume", N. C. Dezendorf, general manager of EMD, stated.

According to statistics compiled during the two years the project has been under development at EMD, railroads have spent more than $6½ billion for new equipment and facilities during the five years following World War II, although less-than-carload shipments declined steadily during this period and over-all freight traffic had only a 3.6 per cent average annual increase. Motor carriers had a rapid increase in freight revenues on a ton-mile basis, but have experienced more and more difficulty operating at a profit on long inter-city hauls where they have encountered state load restrictions, weight-distance laws, and inadequate systems of interstate highways.

Organizational News

Hyster Service Manager

James L. Woodley has been promoted to the position of general service manager of Hyster Co. Formerly production manager at the Danville, Ill. factory, he will now work out of the Portland, Ore. office.

Mr. Woodley has been with the company since 1945, starting in assembly work at the Peoria factory. Before joining Hyster, he had been employed by the Sperry Gyro Co. and the Caterpillar Tractor Co.

Sealed Power Retirement

Effective the end of this year, Lester G. Matthew, vice president and treasurer of the Sealed Power Corporation, retires. He has been with the corporation since 1924 when the No-Leak-O Piston Ring Co., with which he was associated, was taken over by Sealed Power.

Mr. Matthews served in various capacities until 1932 when he was made general sales manager. In 1937

he was elected assistant treasurer and was elevated to treasurer in 1948. He was elected vice president in 1952 and has been a member of the board of directors since 1941.

Alco Sales Appointments

The American Locomotive Co. announces four appointments in its sales organization. W. G. Lockwood has been named district manager for the southeastern sales district. R. M. Darrin, Jr., and R. K. McCoy were named assistants to W. A. Calison, vice president in charge of eastern regional sales. H. M. Short is now assistant to G. P. Link, manager of renewal parts sales, at Schenectady.

In another announcement, Jack W. Harris was named sales engineer in charge of valve sales for process and general industries, in a planned expansion of the Beaumont Iron Work's valve business. This subsidiary, in recent years, has been diversifying its product lines beyond the oil drilling and production equipment in which it formerly specialized. It represents a new step in coordinating sales efforts with the parent company.

D. H. Spicer

E. W. Spannhake

Bosch Sales Service Head

Donald H. Spicer, American Bosch vice president in charge of manufacturers sales for the corporation, has also been placed in charge of sales service activities.

Mr. Spicer replaces W. C. Robinson, vice president, who is now heading the project of constructing a branch plant in Columbus, Miss. He came to Bosch last year from the World Bestos Co., where he had served as president since 1941.

LeTourneau Engineering Head

E. W. Spannhake has been named director of engineering and research for the LeTourneau-Westinghouse Co., new subsidiary of Westinghouse Air Brake Co. He will be responsible for coordinating engineering functions involving product research, design, and development.

Mr. Spannhake has been associated with Barnes and Reinecke, Inc. for the past five years. Prior to that he was with American Bosch Co., American Locomotive Co., and the Lima-Hamilton Co. For some time he has been engaged in private engineering consulting work both here and abroad and has had wide experience in the industrial and heavy machinery field.

Snap-Tite Representative

Gulf States Distributing Co., Houston, Texas, Robert H. White, president, has been appointed sales representative for Snap-Tite, Inc. in Texas.

Delco Sales Manager

Delco Products Div. of General Motors Corp. announces the appointment of John E. McNeil to the position of western district sales manager. Mr. McNeil has been associated with the division since 1942 in various engineering and sales capacities.

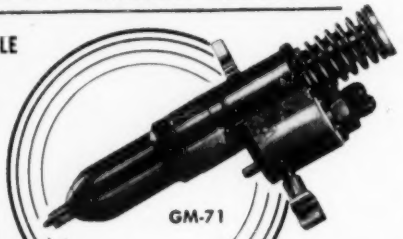
G&K DIESEL SERVICE

Offers at LARGE SAVINGS

INTERCHANGEABLE
FACTORY NEW
FIELD TESTED
PROVEN

WORLD FAMOUS "FERA"

Imported From Italy



✓ INJECTOR & FUEL PUMP PARTS for
✓ CATERPILLAR – BOSCH
✓ G. M. & INTERNATIONAL

INJECTOR EXCHANGE with NO-RE-WORKED PARTS USED

WRITE FOR BULLETIN → G & K DIESEL SERVICE
12 ATLANTIC AVE.
BOSTON, MASS.

STATEMENT OF THE OWNERSHIP, MANAGEMENT AND CIRCULATION REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233)

State of New York } ss.
County of New York }

Of DIESEL POWER & DIESEL TRANSPORTATION published monthly at Kutztown, Pennsylvania, for October 15, 1953.

1. The names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Diesel Publications, Inc., 192 Lexington Ave., New York 16, N. Y. Editor, Brian P. Emerson, 192 Lexington Ave., New York 16, N. Y. Managing editor, None. Business manager, A. N. Goding 192 Lexington Ave., New York 16, N. Y.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.)

Diesel Publications, Inc., 192 Lexington Ave., New York 16, N. Y.; Jessie W. Rosencrans, Chappaqua, New York; Dorothy R. Brighton, Chappaqua, New York; George R. Brighton, Chappaqua, N. Y.

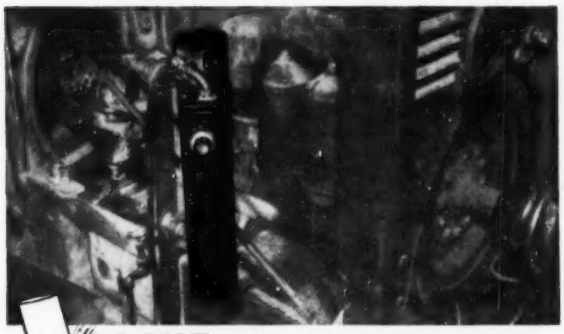
3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state).
None.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bonafide owner.

5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: (This information is required from daily, weekly, semiweekly, and triweekly newspapers only.)

DIESEL PUBLICATIONS, INC.
GEORGE R. BRIGHTON, Pres.
(Signature of editor, publisher, business manager, or owner)

Sworn to and subscribed before me this 2nd day of October, 1953.
ROSE VINE, Notary Public
State of New York No. 24-4102100
Qualified in Kings County
Certificates filed with Kings & N. Y. County Clerks
(SEAL) Commission expires March 30, 1955



SAVE MONEY & MAN-HOURS with F-A-S-T COLD-MORNING STARTS

WRITE FOR: BULLETIN 701
...It tells all about Chromalox Circulation Heaters and shows how to prewarm diesel engines, preheat fuel oils and other money saving uses.

Chromalox gives you a simple, easy way to avoid downtime and lost man-hours on cold mornings. Dependable, "packaged" Chromalox electric circulation heaters can be quickly and easily attached with flexible couplings to your engine cooling systems. Thermostatic controls provide fully automatic operation. 60-33

EDWIN L. WIEGAND COMPANY
7665 Thomas Blvd., Pittsburgh 8, Pa.

CHROMALOX — Electric Heat for Modern Industry

"FIXED-READING" PREMAX

MODEL YRF
ENGINE PRESSURE INDICATOR
for **DIRECT-READING** OF **COMPRESSION** AND **FIRING PRESSURES**
OF EVERY TYPE OF DIESEL ENGINE

ONE OF THE FEATURES Responsible for Its Overwhelming Preference by Leading Diesel Manufacturers and Operators

Successive readings may be taken rapidly since no venting of the instrument is required between readings. No closing of valves required to change from firing pressure to compression pressure reading.

For other features, write for Bulletin 294

ACCURATE PRESSURE READINGS as high as 1700 P.S.I.

BACHARACH
INDUSTRIAL INSTRUMENT CO.
7301 PENN AVENUE • PITTSBURGH 8, PA.

Free For Every GM DIESEL USER

New 48 Page Guide

Packed with Time-Saving, Money-Saving Kent-Moore Special Service Tools

Now available. Kent-Moore's comprehensive new GM Diesel Service Tool Guide. Describes and illustrates more than 300 special tools, developed expressly to meet the essential maintenance requirements of your GM Diesel engine applications. Tools that will save you money, time, and labor. Send for your copy of this Guide today! It's FREE!

KENT-MOORE ORGANIZATION, INC.
Engineers and Manufacturers of Special Service Tools and Equipment
5-103 GENERAL MOTORS BLDG. • DETROIT 2, MICHIGAN

For FUEL TRANSFER and HYDRAULIC GOVERNOR Service

TUTHILL

MODEL L PUMPS ARE PERFORMANCE-PROVED

Throughout the diesel industry, Tuthill Model L pumps are recognized for their dependability in fuel transfer and hydraulic governor service. Model L is a mechanically-sealed, positive displacement internal-gear rotary pump, assuring quiet, leak-free operation with low power consumption. Capacities from .33 to 6 g.p.m. in wide pressure ranges. Available as single or double-pump units. Write for Catalog No. 101 including Pump Guide for diesel applications.

TUTHILL PUMP COMPANY
Dependable Rotary Pumps since 1927
939 East 95th Street, Chicago 19, Ill.

Canadian Affiliate: Ingersoll Machine & Tool Company, Ltd., Ingersoll, Ontario, Canada

FUEL INJECTION SALES & SERVICE

SAVE TIME AND MONEY BY EMPLOYING FUEL INJECTION SPECIALISTS

CALIFORNIA

D—I—G—S
Diesel Injection & Governor Service, Inc.
authorized AMERICAN BOSCH — SALES & SERVICE
AMERICAN HAMMERED PISTON RINGS
Specializing in all types fuel injection systems & governor repair
985 Seventh St. Oakland, Calif.
Phone: Templebar 6-0733

FLORIDA

MIAMI—IN FLORIDA
FLORIDA DIESEL SERVICE CO.
American Bosch Fuel Injection Service
LEECE NEVILLE—DELCO WICO-FAIRBANKS MORSE
1930 N. Miami Ave. Phone 35015

MARYLAND

CENTRAL DISTRIBUTORS
Maryland — Delaware — District of Columbia
For American Bosch and Scintilla Diesel Fuel Injection Equipment Service and Sales
PARKS & HULL
Automotive Corporation
1033 Cathedral Street — Baltimore, Maryland — SA. 7-8383

MASSACHUSETTS

NEW ENGLAND SERVICE
W. J. CONNEL CO.
Diesel Fuel Injection and Governor Service
Newton Industrial Center BOSTON, 64 DEcatur 2-3630
Airport Road HARTFORD, CONN. Tel. 5-3403

MISSISSIPPI

Womack Brothers **DIESEL SERVICE**
★★★★★★
Diesel Fuel Injections, Starting Lighting, and Magneto Sales and Service
1321 S. Gallatin St. Jackson, Mississippi

MISSOURI

DIESEL FUEL INJECTION SERVICE CO.
9331 S. Broadway
St. Louis 23, Missouri

DISTRIBUTORS OF FUEL INJECTION EQUIPMENT
We service and stock parts for:

American Bosch
Bendix Scintilla
Adeco Products
Demco
Cooper-Bessemer
Fairbanks Morse O.P.
Excello
Caterpiller Nozzles
Cummins Nozzles
GM. 71 Series
GM. 567—278—268
Woodward Governors
Pierce & Handy Governors
Bacharach Nozzle Testers
Motorite Compression Testers
American Bosch Fuel Filters

Phone: Vernon 2-2121

MISSOURI

ST. LOUIS, MO.
2900 Washington Blvd. Phone: Jefferson 7200
Electric Parts & Service Co.
American Bosch Fuel Injection—Electrical Carburetor & Magneto Service

NEW YORK

AUTHORIZED SALES & SERVICE
American Bosch — Bendix — Demco
We service all makes of
Fuel injection equipment & Hydraulic Governors
A & D Diesel Service, Inc.
145 — 21st St. Brooklyn 32, N. Y.
South 8-3461-7637

NEW YORK

CORETTI-GROSS, Inc.
Complete Engine & Accessory Unit Reconditioning
Gasoline & Diesel
44 SECOR LANE PELHAM MANOR 65, N. Y.
NYC Phone FAirbanks 4-7700 PElham 8-3900

NORTH CAROLINA

Don't Neglect **THE FUEL INJECTION EQUIPMENT ON YOUR DIESEL ENGINE . . . . .**

Getting top performance from a Diesel engine depends on the condition of the fuel injection system. Play safe by getting in touch with us. We have factory trained mechanics and the official repair and testing equipment needed for doing the job the right way.

CAROLINA RIM & WHEEL CO.
301 East 8th St. Phone 7-1093
CHARLOTTE, N. C.

NORTH CAROLINA

DIESEL INJECTION SALES & SERVICE
fully equipped to service
American Bosch, Bendix Scintilla, Caterpillar, Cummins and International fuel systems
Pierce, Marquette & Woodward governors
3015 HILLSBORO STREET RALEIGH, N. C.

OKLAHOMA

MAGNETO IGNITION COMPANY, INC.
TULSA, OKLAHOMA
Authorized Service and Sales
AMERICAN BOSCH — SCINTILLA
701 West 5th PH-2-8197

PENNSYLVANIA

SULLIVAN BROS.
Fuel Injection—Governors
American Bosch Distributors
1718 Fairmount Avenue
445 North 63rd Street
PHILADELPHIA PENNSYLVANIA

TENNESSEE

AMERICAN BOSCH SERVICE STATION
Genuine Parts and Complete Rebuilding
Cummins — Waukesha — Buda — Nordberg — Kohler Engines
PRECISION PARTS CORPORATION
400 N. First St. Nashville, Tenn.

FUEL INJECTION SALES & SERVICE

SAVE TIME AND MONEY BY EMPLOYING FUEL INJECTION SPECIALISTS

TEXAS

BEARD and STONE

FUEL INJECTION — ELECTRICAL — CARBURETOR AND MAGNETO SERVICE

Houston - Dallas - Texas

VIRGINIA

DIESEL INJECTION SALES & SERVICE

Fuel Injection-Governor Specialists

SERVICE SALES: All Makes & Types

814 8th Street, SALEM, VIRGINIA

808 Union Street, NORFOLK, VIRGINIA

TEXAS

Womack Brothers DIESEL SERVICE

Diesel Injection Pump & Nozzle *Sales & Service*

123 W. Carolina, SAN ANTONIO, TEXAS

1302 Caldwell, CORPUS CHRISTI, TEXAS

WASHINGTON

SEATTLE INJECTOR CO.

Fuel Injection Equipment and Accessories for Internal Combustion Engines

Sales Service

2706 Second Avenue, Seattle 1, Washington

Telephone SEneca 2966

Proto Sales Manager

Appointment of H. W. Oetjen as sales manager for Proto tools has been announced by the Plomb Tool Co. In his new position, Mr. Oetjen will supervise all sales in the United States. He was formerly director of marketing and research.

Frontier Industries Director

Ralph S. Damon, president of Trans World Airlines, was elected a director of Frontier Industries, Inc., at a recent meeting of the board. In joining the board as its seventh member, Mr. Damon, one of the corporation's charter stockholders, becomes the first director to be recruited outside of western New York business circles.

Federal-Mogul Changes

Federal-Mogul Corp. announces three managerial changes. Robert E. Klare, formerly manager of the manufacturing plants at Greenville and St. Johns, Mich., has been promoted to general manager of all manufacturing operations. Carl F. Brown will succeed him as manager of the Greenville plant and William C. Robertson has been named manager of the St. Johns operation.

Mr. Klare has been with the organization since 1943. He was manager of the San Francisco and Fresno plants until 1946 when he was transferred to St. Johns to direct operations of the plant being established at that time. In 1948, he was given the managership of the Greenville plant and last year, the St. Johns plant was added to his responsibilities.

R. E. Klare

R. A. Armstrong

C. F. Brown

W. C. Robertson

Mr. Brown, a newcomer to the company, was formerly manufacturing manager of the Hupp Corp. Mr. Robertson, who has been with the company since 1937, has been general production supervisor at St. Johns for five years. His experience also includes two years as manager of the Cleveland plant and superintendent of the San Francisco and Fresno plants.

Sharples District Manager

Robert A. Armstrong has been appointed Philadelphia district manager of The Sharples Corp. He joined the corporation in 1946 and was assigned to the San Francisco office. In 1950 he went to Philadelphia as assistant to J. E. Paul, who died suddenly in September.

New Diesel Injection Branch

Diesel Injection Sales & Service announces establishment of a branch at Raleigh, N. C. The branch will be under the management of Alton C. Deans, who will be assisted by John Chason.

For the past two and one-half years, Mr. Dean has been located at the company's main plant in Norfolk. He was formerly associated with the Paxton Co. Mr. Chason has been in the employ of Diesel Injection for the past four months. He was recently with the North Carolina Equipment Co. in the capacity of a fuel injection service man.

Canadian Pacific Appoints

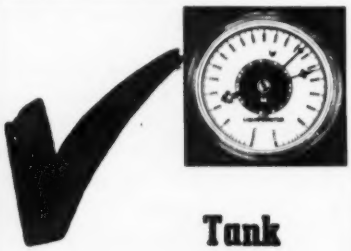
D. S. Thompson has been appointed to the newly created post of vice president, operation and maintenance, of the Canadian Pacific Railway Co. He was formerly vice president of the Prairie region and will be succeeded in that post by G. N. Curley who is now general manager of the eastern region.

WANTED G. M. "71"
Discarded injector parts & assemblies.
10 to 1000
Interstate diesel service, incorporated
7120 CARNEGIE AVE. • CLEVELAND 3, OHIO

They're Ready Now
To Fill Your Needs For
Trained DIESEL MEN!

UEI graduates are energetic, willing workers. They have good basic training in operation, maintenance and repair of all types of Diesel engines. The Diesel man you want is ready to go to work for you in the U.S. or Canada, or will travel farther if the opportunity is right. Tell us your needs.

WRITE TODAY!
UTILITIES
ENGINEERING INSTITUTE
DIESEL DIVISION
2523 Sheffield Ave.
Chicago 14, Ill.
Training Men for Industry Since 1927


Tank
Contents At A Glance
With Liquidometer remote reading fuel storage tank gauges you can check quickly and accurately oil deliveries, consumption and amount on hand. No Diesel plant is complete without one. Liquidometer or Levelometer models are available for tanks of any capacity.
Write for complete information
THE LIQUIDOMETER CORP.
36-24 Skillman Ave., Long Island City, N. Y.

Dravo Publications Manager

The appointment of Garland C. Raines as manager of publications has been announced by the Dravo Corp. Mr. Raines, formerly with Westinghouse, will be in charge of monthly and quarterly company publications.

Exide Organizational Change

Roland Whitehurst has been appointed general manager of the industrial products division by the Electric Storage Battery Co. to supplement his activities as vice president and director of the company. The appointment was a final step in the complete separation of company operations into two divisions, industrial products and automotive products.

Mr. Whitehurst was first employed by the company in 1908 as an office boy. In subsequent years he served as sales representative and was appointed manager of the Washington branch in 1920. In 1942 he was made sales manager and became vice president of sales in 1948. He was elected to the board of directors in 1951.

Buda Appoints Oregon Manager

Buda Engine and Equipment Co., wholly owned subsidiary of the Buda Co., announces the appointment of C. L. Thompson as general manager of the company's Oregon branch. He was formerly assistant general manager of the California branch.

The appointment is in preparation for a planned expansion in the area for the company's diesel, natural gas, and gasoline engines and its material handling equipment and railway supplies sales and services. The company expects to take advantage of the forecasted growth of logging, agriculture, trucking, and general industry in Oregon and counties of adjoining states.

Airway Engineering Director

Airway Products, Inc. announces the appointment of Ernst F. Klessig as director of engineering, as a major step in the previously announced reorganization of the company toward specialization in the field of power hydraulics. Mr. Klessig was formerly executive design engineer at Vickers.

Consult ELLWOOD
on all Your Forging
Requirements

Quality Precision Crankshafts
For Diesels — Since 1910 . . .
ELLWOOD CITY FORGE COMPANY
CRANKSHAFTS · CONNECTING RODS
MACHINE FORGINGS
ELLWOOD CITY, PENNA.

FOR SALE

One General Motors Mod. 8-268-A, 1200 R.P.M. to Westinghouse 250 KVA, 3/60/450 volt, 1200 R.P.M.
Two General Motors Mod 3-268-A, 1200 R.P.M. one to Westinghouse 125 KVA, 3/60/450 volt, 1200 R.P.M. and other to Delco 120/240 volt, D.C., 1200 R.P.M.

P. A. HENAULT
25167 Grand River Ave. Detroit 19, Mich.

DIESEL ENGINES
Marine Stationary
GENERATORS
All sizes from 10 HP — 2000 HP
ALJON ELECTRIC DIESEL CO.
904-10 Pacific St. B'klyn 38, N.Y.
STerling 3-6515 Cable: ALJONDIS

DIESEL PARTS

Series 71
278A-268A
12-567 ATL
Hercules – Buda
FM 38D – 8⅛
"Caterpillar"
Price list on request
RODER-BLACKBURN
INTERNATIONAL CORPORATION
149 B'way, N.Y.C., N.Y. Dept. DP 9

MEN TRAINED
IN PROTECTIVE MAINTENANCE AND GENERAL OVERHAUL
Diesel Engines, Tractors and Heavy Equipment
We specialize in the practical phase of training. Shop Method Home study. If you are employed in this field and need better "Know How", or if you are an Employer and need trained Men, Write Today! INTERSTATE TRAINING SERVICE, Dept. 28-L, 4035 N.E. Sandy Blvd., Portland 13, Ore.

FOR SALE
130 HP Superior Diesel Engine, 3 Cylinder, Type VDBM
9" Bore, 12" Stroke, 600 RPM—
Excellent Condition
10 x 10 and 8 x 8 York Ammonia Compressors
JOHN F. CARSON
A & Venango Sts. Philadelphia 34, Pa.
GArfield 6-2221

R. M. Ellis

National Supply Representative

R. M. Ellis, formerly factory representative in the United States and Canada for Lister-Blackstone, Inc., has been appointed a special representative in Canada for the engine division of the National Supply Co., Ltd. Mr. Ellis will seek to develop additional application of Superior and Atlas diesel engines.

Thew Shovel Elevations

The Thew Shovel Co. announces the promotion of R. G. Thibaut, formerly assistant service manager, to service manager, and C. W. Raby, traffic manager, to assistant service manager. Mr. Thibaut succeeds R. P. Kelly who recently passed away.

Dresser Industries Controller

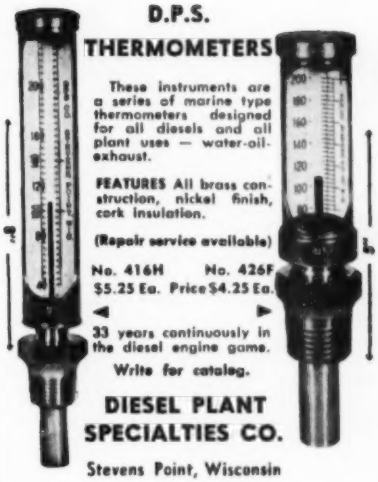
J. Curran Freeman has been appointed controlled of Dresser Industries, Inc. He came to the corporation from Ford Motor Co. and prior to that was associated with Allis-Chalmers.

Allis-Chalmers Engineer Dies

Walter Giger, long active in electric, diesel, and gas turbine locomotive development, and an application engineer in the electrical section of the Allis-Chalmers Co. Norwood works, died suddenly in Switzerland. He was 57 years old.

A native of Zurich, Mr. Giger had extensive experience in American and European traction equipment advancements. He first joined the company in 1932 and took part in development of railway equipment being built for the Pennsylvania Railroad's electrification program. After completion of this work, he returned to the Brown-Boveri Co. in Switzerland. He rejoined Allis-Chalmers in 1947.

D.P.S. THERMOMETERS



These instruments are a series of marine type thermometers designed for all diesels and all plant uses — water-oil-exhaust.

FEATURES All brass construction, nickel finish, cork insulation.

(Repair service available)

No. 416H $5.25 Ea. Price
No. 426F $4.25 Ea.

33 years continuously in the diesel engine game.
Write for catalog.

DIESEL PLANT SPECIALTIES CO.
Stevens Point, Wisconsin

DIESEL ELECTRIC POWER

for IMMEDIATE SHIPMENT
Unit Capacities 100 to 1875 Kva A.C. 60-60 Cycle-Various Voltages

Write or wire today for bulletins and complete information regarding these fine fully guaranteed, low cost DIESEL ENGINE GENERATING UNITS. Visit our plants at Sausalito (S. F.), California, and Jersey City, N. J., and see units in operation on our test stand.

"SPECIALISTS IN DIESEL POWER"

A. G. Schoonmaker Co., Inc.
56 Church St., New York 7, N. Y.

PRICED TO SELL:

2 COMPLETE POWER PLANTS

1—500 HP—474 KVA, consisting of 3 Cooper-Bessemer Diesels direct connected to G E Generators.
1—500 HP—175 KW consisting of 2 Busch-Sulzer Diesels direct connected to G E Generators.

TEXAS POWER & LIGHT CO.
P. O. Box 6331 DALLAS, TEXAS
Or Phone
ST-5411 — STA. 382

ADVERTISERS' INDEX

A & D Diesel Service, Inc. 84
Aerofin Corp. ***
Aljon Electric Diesel Co. 87
Allison Division General Motors Corp. 26
American Air Filter Co., Inc. ***
American Bosch Corp. ***
American Brass Co. 22
American Locomotive Co. ***
American Motors Co. 80
Atlantic Metal Hose Co. ***

Bacharach Industrial Instrument Co., Inc. 83
Baldwin-Lima-Hamilton Corp. 14
Beard & Stone 85
Bendix Aviation Corp. Scintilla Magneto Div. ***
Borg-Warner Corp., Rockford Clutch Div. 70
Brodie System ***
Brown & Sharpe Mfg. Co. 78
Brush ABOE, Inc., Petter Engine Div. ***
Burgess-Manning Co. ***
Burlington Instrument Co. ***

Carolina Rim & Wheel Co. 84
Carson, John F. 87
C. A. V., Ltd. 73
Chicago Metal Hose Division **
Chicago Pneumatic Tool Corp. 20
Cities Service Oil Co. 15
Columbia Electric Mfg. Co. 74
Connell Co., W. J. 84
Coretti-Gross, Inc. 84
Cook Mfg. Co., C. Lee 2
Cooper-Bessemer Corp., The 4
Cummins Engine Co. ***
Cuno Engineering Corp. 11

De Laval Separator Co. ***
Delco Products Div., General Motors Corp. 8
Delco-Remy Div., General Motors Corp. 18
Detroit Controls Corp. ***
Detroit Diesel Engine Division, Gen. Motors ***
Diesel Fuel Injection Service Co. 84
Diesel Injection & Governors Service 84
Diesel Injection Sales & Service 84, 85
Diesel Plant Specialties Co. 87
Dexter Folder Co., Miehle-Dexter Supercharger Div. 23
Dollinger Corp. ***
Donaldson Co., Inc. ***

Electric Parts & Service Co. 84
Electric Storage Battery Co., The 5
Electro-Motive Div., Gen. Motors Corp. ***
Electro Products Laboratories ***
Elliott Co. ***
Ellwood City Forge Co. 86
Enterprise Engine & Machinery Co. ***
Erie Forge & Steel Corp. Third Cover

Fairbanks-Morse & Co. 9
Fairchild Engine & Airplane Corp. ***
Federal-Mogul Corp. 25
Fitzgerald Mfg. Co. ***
Flexonics Corp. ***
Florida Diesel Service Co. 84
Fram Corp. 79
Fulton Sylphon Div., Robertshaw-Fulton Controls Co. 13

G & K Diesel Service 82
General Motors Corp., Allison Div. 26
General Motors Corp., Delco Products Div. ***
General Motors Corp., Delco-Remy Div. 18
General Motors Corp., Detroit Diesel Engine Div. ***
General Motors Corp., Electro-Motive Div. ***
General Motors, Harrision Radiator Div. ***
Gulf Refining Co. ***

Hallett Manufacturing Co. 19
Hancock Diesel Service 107
Harnischfeger Corp., P & H Diesel Div. ***
Harrison Radiator Div., Gen. Motors Corp. ***
Henault, P. A. 87
Hilliard Corporation, The ***

Illinois Testing Laboratories, Inc. 74
Ingersoll-Rand Corp. ***
Interstate Diesel Service Inc. 86
Interstate Training Service 87

Johnson Bronze Co. ***

Kent-Moore Organizations, Inc. 83
Kiene Diesel Accessories, Inc. 81
Koppers Co., Inc., American Hammered Piston Rings Dept. 7

Lanova Corporation ***
Leece-Neville Co. ***
Link-Belt Co. ***
Liquidometer Corp., The 86
Luber-Finer, Inc. 71

Madison-Kipp Corporation ***
Magneto Ignition Co., Inc. 84
Manzel 75
Marine Products & Engineering Co. ***
Maxim Silencer Co., The ***
Miehle-Dexter Supercharger Div., Dexter Folder Co. 23

National Welding & Grinding Co. ***
Nordberg Mfg. Co. 17
Nugent & Co., Wm. W. 69

Oakite Products, Inc. 75

Parks & Hull 84
Penn Controls, Inc. 77
Petter Engine Div., Brush ABOE, Inc. ***
Pierce Governor Co., The 78
Powers Regulator Co. ***
Precision Parts Corp. 84
Pure Oil Co., The 21
Purolator Products, Inc. ***

Quincy Compressor Co. ***

Read Standard Corp. 68
Rockford Clutch Div., Borg-Warner Corp. 70
Roder-Blackburn International Corp. 87
Roper Corp., George D. ***

Schoonmaker, A. G., Inc. 87
Scintilla Magneto Div., Bendix Aviation Corp. ***
Sealed Power Corp. 30
Seattle Injector Co. 85
Sharples Corp., The 66
Sinclair Refining Co. 10
Snap-On Tools Corp. 67
Snow-Nabstedt Gear Corp. 72
Standard Oil Co., Inc. (California) 27
Standard Oil Co., Inc. (Indiana) Fourth Cover
Sullivan Brothers 84
Synchro-Start Products 28

Texas Company, The 2nd Cover & 1
Texas Power & Light Co. 87
Thomas Flexible Coupling Co. ***
Tide Water Associated Oil Co. 6
Tuthill Pump Co. 83

Utilities Engineering Institute 86

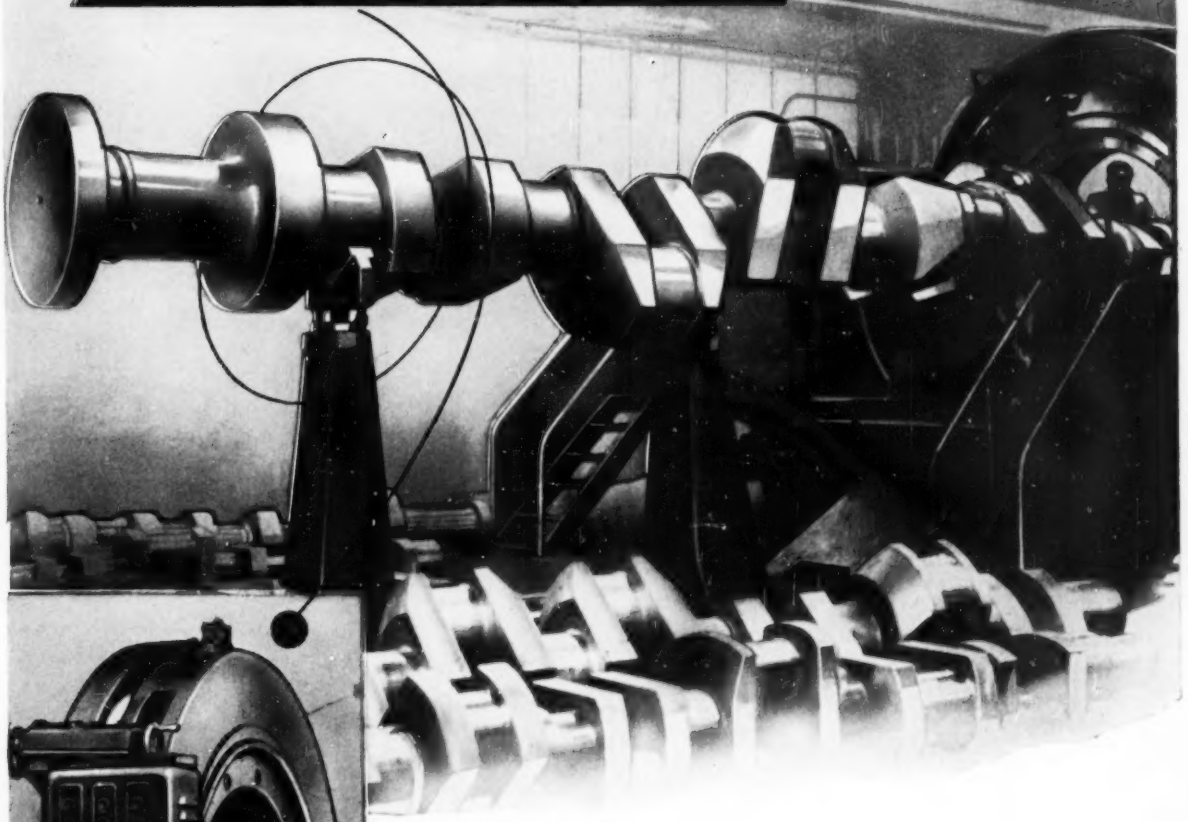
Van Der Horst Corp. 12
Van Norman Co. ***
Vellumoid Co. ***
Viking Pump Co. 81

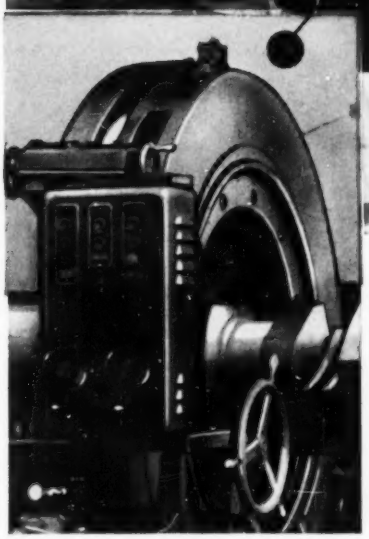
Waukesha Motor Co. 63
Weston Electric Instrument Corp. ***
White-Roth Machine Corp. 80
Wiegand Co., Edwin L. 83
Worthington Corporation ***
Womack Brothers 84, 85
Winslow Engineering Co. ***
Wyman-Gordon Co. 16

Young Radiator Co. ***

A PIN TURNING MACHINE that revolves AROUND the WORK?

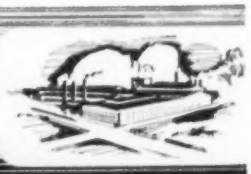
This one does at ERIE FORGE — to achieve MAXIMUM accuracy!





AT ERIE FORGE & STEEL CORPORATION you'll find the most accurate pin turning machine in the country. The crankshaft is held motionless . . . the machine revolves around the work! The crankshaft is accurately aligned, then bolted down . . . it cannot move off center! As this 50,000 pound crankshaft is automatically moved, from throw to throw, through the machine opening, it is finish turned to close tolerances and a mirror finish. This exceptional degree of accuracy is standard practice at Erie Forge & Steel Corporation. Every operation—from ingot to finished crankshaft—is under one control, one responsibility. Consult with us on your next requirements involving crankshafts, connecting rods or allied items.

ERIE FORGE & STEEL CORPORATION
ERIE, PENNSYLVANIA



STANDARD HD
TRADE MARK
OIL

Running up record ring life with . . .

● In 1947, operators of a midwest municipal power plant put a new 1060-hp diesel unit into service, using STANDARD HD Oil for lubrication.

After 19,000 hours' operation, the unit was shut down for inspection. The engine was entirely free from deposits and showed minimum wear. Piston rings were in excellent condition and were replaced in the engine for further service. This unit is still going strong with a total of 23,000 hours of trouble-free operation on its original piston rings.

Installed in 1950, a 1755-hp, supercharged diesel engine in this plant is running up another record for low maintenance with STANDARD HD. After more than 9,000 hours' operation, this unit was inspected and found unusually clean. Rings were free, and it was not necessary to remove them for cleaning purposes.

The outstanding performance of STANDARD HD Oil in all types of diesel-generating installations provides the evidence of the benefits it can bring in your diesel units. The Standard Oil lubrication specialist serving your immediate area of the Midwest will be glad to give you this evidence, using plants with which you may be familiar. Phone your local Standard Oil office. Or write: Standard Oil Co., 910 S. Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY

STANDARD

(Indiana)